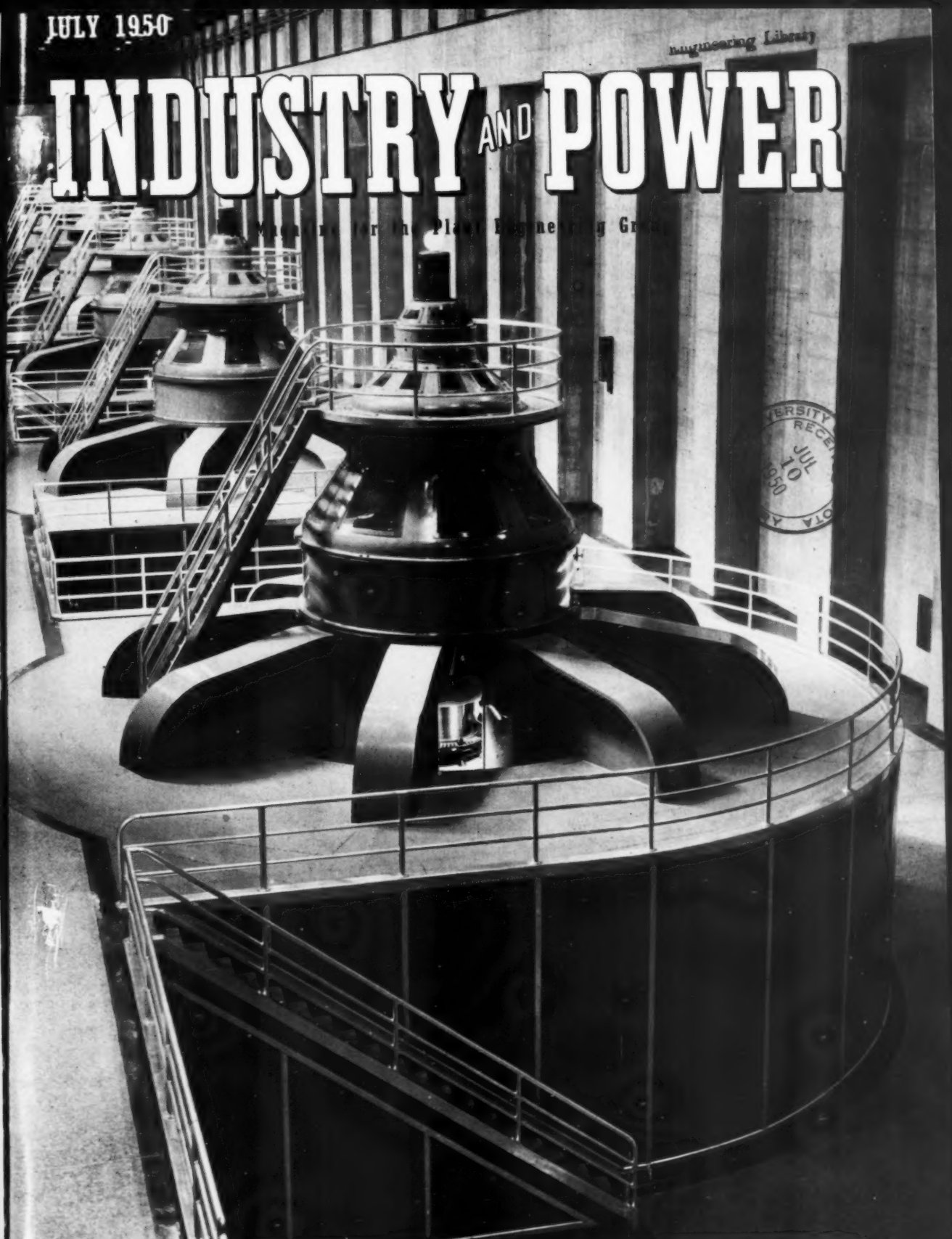
JULY 1950

Engineering Library

INDUSTRY AND POWER

Magazine for the Plant Engineering Group



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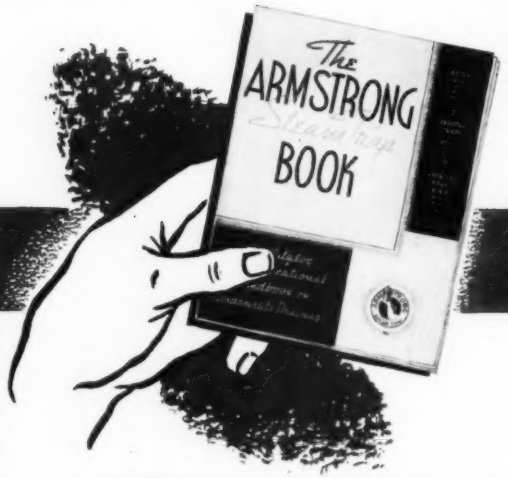
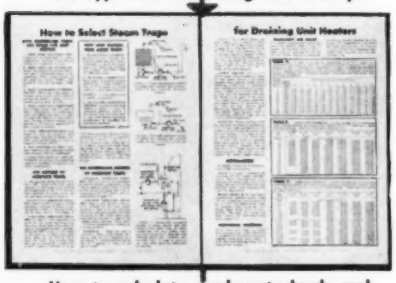
"You can engineer any trapping job with this book"

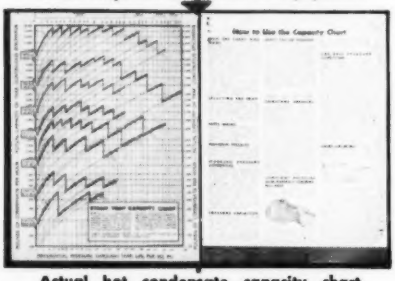
YOU CAN'T GO WRONG



Physical data and prices on all sizes and types of Armstrong steam traps.



How to calculate condensate loads and select traps for all classes of equipment.



Actual hot condensate capacity chart for every Armstrong trap, recommended safety factors and specific recommendations for many types of equipment.

THERE is no guess work about steam traps or steam trap selection when you have the 36-page Armstrong Steam Trap Book to work with. You don't waste money on traps that are too big for the job. You don't get inefficient drainage with traps that are too small.

This book explains the design, operation and advantages of Armstrong steam traps, specifies materials used, gives complete dimensional data, includes list prices, actual capacities under working conditions. There are 10 pages of tabular and technical data explaining how to calculate condensate loads and select the correct trap for the job, complete instructions on installation and maintenance. The Steam Trap Book also describes Armstrong traps for draining moisture from compressed air systems, Armstrong steam humidifiers for adding moisture to dry air and Armstrong non-condensable gas purgers for removing air from refrigeration systems.

Anyone is welcome to a copy of this useful guide to good trapping practice. Send for yours today.

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Mich.

ARMSTRONG STEAM TRAPS

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In245

Edited specifically for the plant engineering group—the executives and engineers responsible for the generation, transmission, distribution and utilization of energy in its various forms for power, processing and engineered services

INDUSTRY AND POWER

The Magazine for the Plant Engineering Group

VOLUME 59 **JULY, 1950** **NUMBER 1**

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Cover Illustration

Nevada wing of Hoover Dam power house contains seven 82,500-kva generators with room for one more. Arizona wing now contains five units of the same size with two more on order for early installation. ***Photo by Cliff Segerblom***

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NEW 207 Diagonal Plier

Meet Mr. Plion and his large family of tough, top-quality PROTO* pliers. Included are all common types, several specials and the NEW pliers illustrated. You'll roar with delight at their many features—fine alloy steel, sturdy construction, good balance, correct leverage, ease of operation, properly shaped teeth and sure-grip handles. And now, most PROTO* pliers have lustrous chrome-plating. Choose the pliers you need from the *quality* "lion"—at your PROTO* dealer's. Write for catalog to

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Apropos of—

In-Plant Readership

YOU hear a lot about "pass-along" readership in the general field of magazine publishing. This is supposed to reflect the expansion of the actual circulation figures which comes about through a subscriber's sharing his copy of the magazine with friends. This added readership is an important "plus" which all magazines offer — in varying proportion.

Here at I & P, we call it "In-Plant" readership. We purposely cultivate this kind of readership because it's important for the full utilization of the editorial and advertising content of our magazine.

I & P's single purpose is to help the executives and engineers in the Plant Engineering Group solve their day to day problems—selecting, installing, operating, and maintaining the equipment they need for power, processing, and engineered plant services.

In addition to presenting 100% service editorial, we help I & P do its job through our placement methods. Each copy of I & P is placed with the person directly in charge of the plant engineering function (or a part of that function, in the case of larger plants). Thus, the magazine is read first by a responsible individual who has been informed that I & P contains editorial material aimed directly at the interest level of men under his supervision as well as at his own interests. Because he knows I & P will help those men do a better job, he sees to it that his copy is routed to them.

This plan for "In-Plant" readership is neither conjecture nor wishful thinking on our part. We know this pattern exists and where. Last year we circularized our entire mailing list and received roughly a 26% response. Follow-up mailings this year have given us an additional 34% response. This information is combined with our Verified Readership records to give us a comprehensive picture of readership. The Verified Readership records have been maintained on a day-to-day basis for each plant on our mailing list during the past seven years. This consolidated evidence proves that more than five individuals, on the average, read each copy of I & P. This is published information contained in a recent booklet listing a generous sampling of plants and showing proved readers and their titles. Typical of these listings is the Appleton Company of Anderson, S. C. Readers include: Charles B. Nichols, President; W. G. Stainton, General Manager; C. H. Strickland, Superintendent; S. M. Heggood, Master Mechanic; B. E. Jordan, Jr., Chief Electrician. The pattern for the Celanese Corp. of America at Narrows, Va. includes: M. L. Tyrrell, Plant Engineer; N. J. Holsom, Asst. Plant Engineer; H. O. Arendsee, Engineer in Charge of Power House; R. V. Ott, Electrical Engineer; K. P. Young, Purchasing Agent; and several section engineers. Note how this readership follows the organization of the Plant Engineering Group. In these plants the full value of I & P is being utilized.

You'll be ahead to keep a constant check on the routing of your copy of I & P to make sure it's working full-time in your plant.

M. J. Sanders

Exec. Vice President

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...READY FOR MORE!

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Day in day out . . . year after year . . . for eleven years more than a million tons of rock smashed down and was carried along by a Quaker Ironsides Conveyor Belt. This 24" wide belt takes an impact drop of four feet and runs on a grade that starts at four feet off the ground to a height of fifty-five feet . . . carries 60 to 100 yards of material per hour. After a million tons, it is still good and ready for many more.

Whatever your belting needs in your plant . . . flat transmission belts, V-belts or conveyor belts, you can rely on Quaker for long, performance-proved service. Every belt built by Quaker is thoroughly pre-tested in the plant . . . every type has been performance-proved on the job. To economize on belting, you'll find it pays to Quakerize your plant.

QUAKER PACKINGS FOR SAFER SEALS

Scientifically pre-tested . . . ruggedly performance-proved Quaker Packings are engineered for every use in your plant—for pumps, compressors, water, air and steam lines and many other places where a positive, long-lasting seal is needed.

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Pre-tested for flexibility and strength . . . built to stand abrasion . . . performance-proved for rugged resistance to wear... every Quaker Hose has been scientifically developed for a specific application . . . to provide longer service in your plant. There's a Quaker Hose to meet every industrial requirement.

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NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You are Interested.

301—DRY-TYPE COOLER SAVES WATER

Development of a complete line of 22 standard production dry type fluid coolers has been announced by The Trane Co. Used primarily for air-cooling engine-jacket water and lubricating oil in diesel, gasoline and gas power plants. The dry type fluid coolers have many interesting special applications in chemical and petroleum processing; oil, gas and electrical transmission; metal working and other industries.

Through simple combinations of coil circuits, one standard unit can dissipate heat

from two or three different fluids, at different entering and leaving temperatures and different quantities of liquids. This feature is especially useful in stationary power plants, where one fluid cooler can cool both jacket water and lube oil, as well as helping dissipate exhaust fumes. Capacities of the 22 standardized units range from 66,250 to 7,630,000 Btu per hour. Weights range from 325 lb to 9¼ tons. The smallest standard unit, with an 18 in., one hp fan, will handle 2,200 cfm of air and 20 gpm of water. The largest, with a 144.1 in., 34-hp fan, will handle 220,000 cfm of air and 1,000 gpm of water.

302—METER CHARTS TURBIDITY

Photoelectric instrument, which automatically measures and records the amount of suspended particles in a liquid, has been announced by General Electric's Special

Products Div. Called a "recording turbidimeter," it provides a means for monitoring and controlling processes in water treatment plants or wherever turbidity is of significance. Compact in design, it automatically gives continuous readings of turbidity, alerting the operator when certain predetermined limits are exceeded. The device is expected to fulfill requirements of daily raw water and finished water turbidity reports, which many state health departments require from water plants.

The recording turbidimeter operates on the principle that turbidity of a liquid varies in direct proportion to the ratio of scattered light to transmitted light through the liquid. Since it is a ratio-measuring instrument, results do not vary with color or voltage. The recording element may be furnished calibrated on the silica-scale, or uncalibrated for those who wish to calibrate their own instrument. It can be made to read any desired range of turbidity, such as 0 to 10 ppm, 100 to 1,000 ppm and 90 to 100 ppm. Operating on a 115-v, 50/60-cycle circuit, the equipment has a power consumption of approximately 150 w.

303—POCKET INSTRUMENT INDICATES HUMIDITY

A precision pocket instrument, shorter than a pencil, that shows relative humidity by the accurate wet- and dry-bulb method has been developed by the Weston Electrical Instrument Corp. The "TAG" Pocket Humidicator Model 8704, can be used either

in the hand or mounted on a wall. A simple built-in slide rule converts the wet-bulb and dry-bulb readings directly into relative humidity, eliminating charts or tables.

The device has two etched scale glass thermometers, individually hand-calibrated for permanently accurate readings. These are secured in a sturdy white plastic case by integral resilient mountings. The psychrometric slide rule forms the case cover.

304—CLAMP-ON METER HAS WIDER RANGE

Available from Pyramid Instrument Co., the Amprobe model, A-5-1, is the third to be added to the series of the extraordinarily small, pocket-size volt-ammeters. It has seven ranges: 6.5, 13, 26, 65, 130 amp and 150/600 v. These volt-ammeters are designed specifically for maintenance men, engineers, electricians, and motor repair

and service shops. They are 7⅛ x 2-9/16 x 1⅛ in. and the split-core transformer will handle conductors up to 1⅛ in. in diameter. The transformer core is permanently insulated with a molded plastic cover capable of withstanding 5,000 v a-c.

The case and scale window are molded in one piece of impact-proof plastic, thoroughly insulated, and the scale is visible from any angle. The movement is a large D'Arsonval jeweled type with alnico magnet, completely dust and moisture proofed. Accuracy is plus or minus 3% of full scale. It is packaged in a top grain cowhide case with a zipper closure at no extra cost.

(Continued on page 10)

Announcing the NEW

JENKINS SWINGTITE

with an exclusive new design that assures smooth action, positive closure, and longer life

In the new Jenkins SWINGTITE Fast-Action Bronze Gate Valve, the exclusive rolling disc and guide track design lengthens valve life and assures maximum tightness as it prevents uneven wear of seating surfaces. As the valve is opened or closed, guide rims around the seating surfaces of discs roll freely over guide tracks cast in the body, distributing wear evenly, dislodging foreign matter, and providing a polishing action for seating surfaces.

The SWINGTITE can be opened or closed instantaneously and easily with less than a quarter turn of the malleable iron lever which activates the self-adjusting ball and socket type double disc.

Wherever full, free flow is essential . . . where valve opening or closing must be instantaneous . . . you will see more and more Jenkins SWINGTITE Bronze Gate Valves setting new standards of performance and endurance. They are recommended especially for such services as laundry machinery, dish-washing equipment, gasoline and fuel oil lines, fire extinguishing steam lines in kitchens, and dispensing lines to tanks or vats.

Get all the facts on the new Jenkins SWINGTITE. Find out how much smoother-operating, how much *longer-lasting* these fast-action Bronze Gate Valves can be when *Jenkins* builds them. Send for the new folder, Form No. 196, containing full details. Jenkins Bros., 100 Park Avenue, New York 17, N.Y. Jenkins Bros., Ltd., Montreal.

Sold through leading Industrial Distributors

NO OTHER VALVE of its type HAS THIS FEATURE

Notice the guide rims (A) of the discs which rotate freely on the guide tracks (B) cast in the body, as the valve opens or closes. This roller action provides a self-cleaning and polishing effect, and also distributes the wear, since the seating position of the discs changes with each closing. Rapid, uneven wear is prevented, and continuous tight closure assured.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

(Continued from page 8)

305—MOTORS HAVE INTEGRAL BRAKES

General Electric Small and Medium Motor Div. announces all types of Tri-Clad motors up to 20 hp, 90 ft lb static torque are available with the explosion-proof, electrically operated brake, a product of the

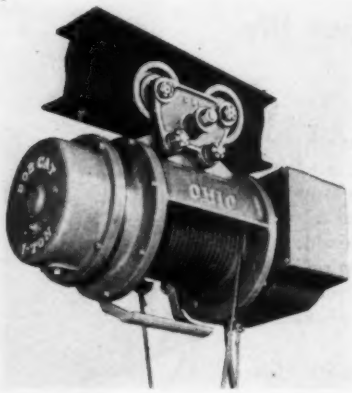
Stearns Magnetic Manufacturing Co. The compact brake-motor retains all the features of the standard Tri-Clad construction, and is for application on cranes, hoists, conveyors, machine tools, printing presses, laundry machines. G.E. assumes all the unit responsibility for both brake and motor.

For flexibility, brake combinations are selected to operate at 100 and 150% of full-load motor torque. A single adjustment nut sets the torque for specific load conditions enabling operation below maximum rated torque to conserve brake linings. Manual release is easily accomplished. All brakes, even on open motors, are totally enclosed, and provide protection from harmful atmospheres, dust, and dirt. The brake will continue to hold even if the power fails.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

306—HOIST DESIGN SAVES SPACE, WEIGHT

Heavy-duty electric cable hoists ranging in lifting capacity from ½ to 5 tons are announced by The Ohio Electric Mfg. Co. Originated and designed by Lisbon Hoist and Crane Co., the Bob-Cat hoist, with the motor totally enclosed within the cable drum, has reduced over-all dimensions and produced a substantial weight saving. The



motor is fully protected against weather, moisture, dust and corrosive atmospheres.

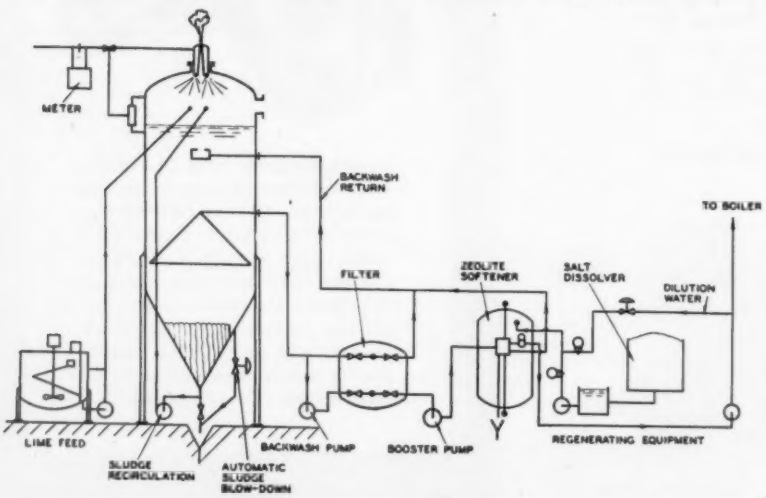
Load sustaining parts made from steel forgings and castings give a factor of safety of over 6 to 1. The special high-torque Ohio motor and gears run in ball bearings.

Gear reduction is accomplished by means of a double internal (epicyclic) gear train that incorporates two Weston-type load brakes with an up-limit cutoff switch. For operation on 220, 380, 440 or 550 v, 3 phase, 60 cycle current, the hoist is furnished with either pendant rope control or push-button control on pendant cable.

307—ZEOLITE SOFTENER BACKS UP HOT LIME UNIT

Cochrane Corp. announces a zeolite softener to be used as the second stage following the first stage unit in which lime is the single reagent. The first stage precipitates the bicarbonates and magnesium in the water supply leaving the remaining hardness to be removed by the zeolite softener, utilizing salt as a regenerant. This unique combination of hot process and zeolite has been made possible by the fact that new high temperature resins used in the zeolite stage will withstand both the temperatures and the pH values attained in the hot-process stage of boiler water treatment.

The advantages include savings in chemicals and capital investment, lower CO_2 in the steam, less floor space and head room required, less operating attention, better control of phosphate excess in the boiler, lower alkalinity and only one chemical needed in the hot process. The process is particularly advantageous in the treatment of turbid surface water high in carbonate hardness and silica, for it combines economical softening, silica removal and clarification process in one apparatus.



308—LUBRICATION DEFIES SOLVENTS, HEAT

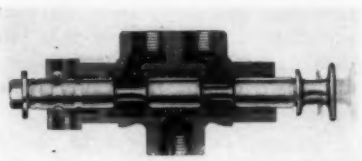
In a large Philadelphia plant with a 700-ft monorail conveyor system, the problem of lasting lubrication through degreasing and drying-oven operations which defied ordinary petroleum products was presented to the Acheson Colloids Corp.

Cans being carried on the rail move through the following sequence of events: degreasing, washing, drying, prime paint coat, drying, final paint coat, final drying. With conventional lubrication, the conveyor moved jerkily, due to gum-up of the lubricant at high temperature and dissolution at degreasing. Breakage and down-time were high.

A switch was made to a colloidal graphite suspension in paint thinner. This microscopically fine solid lubricant is chemically inert and hence impervious to the action of degreaser solvent. It is also unaffected by heat up to 5000 F in inert atmospheres. Sprayed on the conveyor for 1½ hr, one day a week through two guns mounted six inches from the edge of the chain, it provided perfect freedom of motion.

309—VALVES SUPPLIED WITH NEUTRAL POSITION

A new line of neutral valves is available, designed and manufactured by Valvair



Corp. When the valve is in the neutral position, all ports are blocked. It is therefore possible to stop and hold the piston of a single- or double-acting cylinder in any position.

The neutral position valve can be supplied with the following operating mechanisms: knob, lever, clevis or treadle. The valve is available in ¼, 3/8, ½, ¾ and 1 in. pipe sizes. Pressure range is to 175 psi.

310—SEMI-PORTABLE V-ANGLE COMPRESSOR

Ingersoll-Rand has introduced a new line of gas-engine-driven compressors, available in three sizes—110, 165 and 220 hp. These machines consist of 4, 6, and 8 power cylinders respectively, having an 8¼ in. bore and a 9 in. stroke and have 2 power cylinders for each compressor frame. The JVG is a small, compact compressor of the I-R, 4 cycle, V-angle design, having the

(Continued on page 12)

WICKES TYPE A

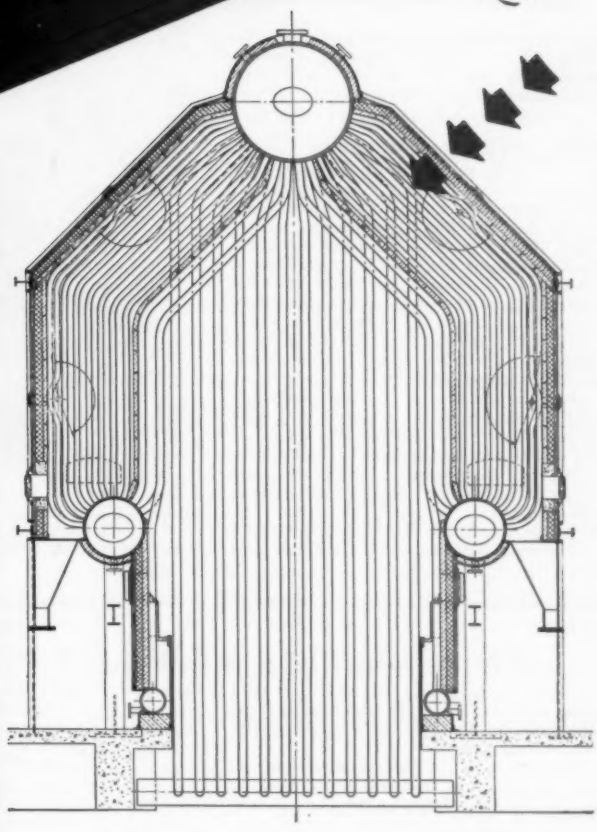
Three outstanding construction and design advantages make the Wickes Type-A Water Tube Boiler the most efficient of its type.

Wickes units have almost twice the black surface common to this class of boiler . . . this increases efficiency through greater heat absorption, permits carrying a higher CO_2.

Wickes steam generators draw the combustion gases through well-insulated passages across rows of staggered tubes . . . speeding optimum convection heat pickup, maintaining high operating efficiency.

Wickes Boilers assure fast, smooth water circulation through two simple U-tubes—higher absorption with no danger of clogging . . . proper baffling for unobstructed flow.

It will pay you to take advantage of Wickes' expert consultation before you buy a boiler. Wickes Steam Generators are sold and serviced the world over. Write today for complete catalog.



Wickes Type-A Water Tube Boiler with 450 HP and 350 lbs. design pressure.

THE WICKES BOILER COMPANY • SAGINAW, MICHIGAN

WICKES

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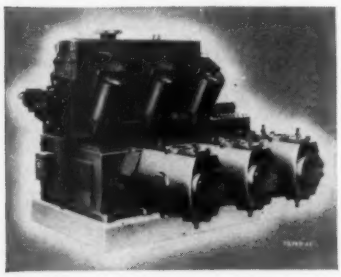
DIVISION OF THE WICKES CORPORATION • RECOGNIZED QUALITY SINCE 1854

(Continued from page 10)

power connecting rods articulated with the compressor rods, and becomes part of the V-angle line extending to 1320 hp.

The compressor is balanced in operation



and light enough to be semi-portable in the field, yet it is built for efficiency, conservative rating, long life and low maintenance for permanent installations.

311—SELENIUM RECTIFIER FOR ELECTROPLATING

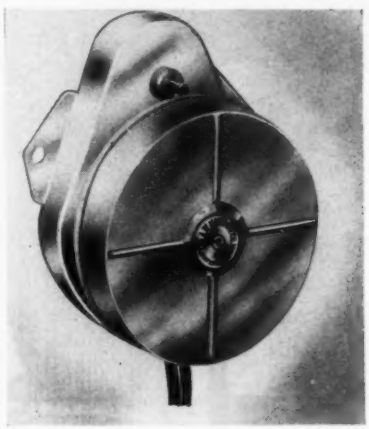
Oil-immersed selenium rectifier especially designed for electroplating, particularly "barrel" plating, has been announced by the General Electric Co., Lighting and Rectifier Div. Hermetically sealed selenium stacks withstand the corrosive atmosphere of a plating room. The new unit is available in two models: 6/12 v and 9/18 v, both rated 1500/750 amps, 230/460 v a-c, 60 cycles, three phase.

Rectifier consists of a transformer, fan, and 12 rectifier stacks arranged in a steel casing. Each stack, hermetically sealed in an oil-filled can, contains matched selenium cells. Mechanically sealed terminals utilize neoprene for sealing and glazed porcelain for insulation. Fan cooled, the rectifiers benefit by receiving the cooling air before the transformers. Each unit consists of two rectifiers with individual bus bars brought out at the rear. These may be connected in series or parallel to give full current at normal voltage or half current at double voltage. Taps are provided to compensate for line voltage variations.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

312—TIMING MOTORS FEATURE HIGH TORQUE

The A. W. Haydon Co. announces a new line of standardized a-c timing motors. They are of the synchronous hysteresis type and combine improved design and performance with lower cost. Features of the new stand-



ardized timing motors are the high starting and running torque and quiet operation. They run at full synchronous speed over a wide range, despite variations as great as 25% in line voltage. There is also a considerable speed range and current rating.

Other features include: slow speed rotor, shaded pole starting, capillary lubrication, welded construction and long life. Motors fitting standard specifications are available immediately from stock, or complete timers incorporating these motors can be especially designed and supplied for volume needs.

314—AIR UNIT REGULATES, FILTERS, LUBRICATES

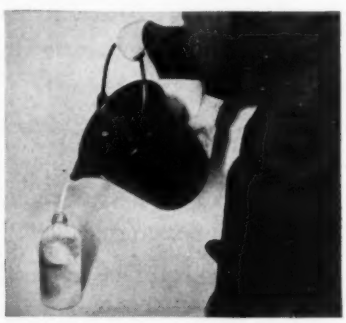
Engineering developments recently incorporated in the "R-F-L" unit, designed and manufactured by the Logansport Machine Co., have resulted in substantially increased efficiency of this well-known air regulator-filter-lubricator. The unit now incorporates a piston-type instead of bellows-type regulator, and the former porous metal air filtering element has been replaced with synthetic-type filtering element. Instead of being attached by means of small screws, the filter cover and regulating valve now screw into the main body of the unit. Gage and lubricator are included as before.

Unit is a compact casting measuring 6 in. square by 4¾ in. deep. It is installed in the intake from the main air line and can be mounted on a central control panel. It regulates air pressure and filters the air.

Two knobs on front panel provide means for accurate regulation of air pressure and amount of oil injected as required by the individual job. A third knob drains the water trap. Indicators provide visibility of both air pressure and oil level.

315—PAIL IS FLEXIBLE NON-CORROSIVE

Practically indestructible, this three gallon chemical pail adds greater safety to the handling of virtually any type of corrosive solution. ACE-HIDE, according to its makers, American Hard Rubber Co. is a new, tough, resilient, high-styrene, co-



polymer rubber that provides an excellent combination of light weight, corrosion resistance and strength.

The pouring spout virtually eliminates costly, dangerous drip and keeps the corrosive chemicals from running down the sides of the pail. Its rim design permits use of a close-fitting, splash-proof cover, and both rim and bottom of pail are reinforced.

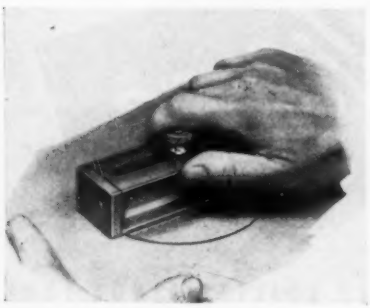
313—GASKET CUTTER IS ACCURATE, HAS WIDE RANGE

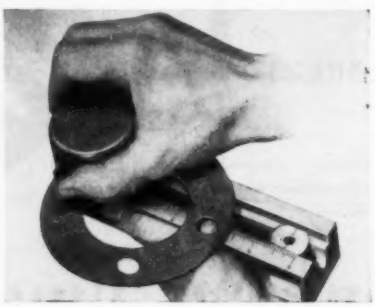
Gasket cutter that will make all sizes from ½ in. to 48 in. in diameter, and cut bolt holes as well, has been developed by The Allpax Co., Inc.

The cutter bar is slotted and of convenient size, one end having a screw plate to hold the cutting knife in position. A center slot in the bar carries the pivot-pin assemblies, constructed so that the distance between pin and cutter may be easily varied and locked for the radius of cut. On the bottom side of the bar are two sets of graduations, one for standard pins used for medium gasket diameters, the other for the offset pins used for very small diameter cuts. For circles larger than 12 in., extension bars for each range to 24, 36 and 48 in. maximum diameters.

Making a gasket is relatively simple. The material is punctured for the center and laid on a board (left) having a center pin socket. The radius of the outer circle of the gasket is set, and the cutter bar is rotated, cutting the material to the selected diameter.

Small gaskets (under 2 in.) and bolt holes are cut with the graduated side of the cutter bar turned up (right). An offset center pin is used with the knob provided. Gaskets as small as ½ in. OD and holes with ¼ in. ID are made by this method.





316—CAPACITOR FABRICATION ALLOWS SMALL SIZE

Extra-severe-service requirements in subminiature size are met by the type P123ZG Aerolite capacitors, announced by Aerovox

(Continued on page 16)

ALL FOR ONE...

but not one for all jobs!

All of these B&W Refractories are designed for one job . . . to give you the longest possible boiler furnace service.

BUT NO ONE refractory can meet all furnace conditions. That's why B&W has developed this complete line of cost-cutting refractories to solve every furnace problem.

Whether your boiler produces 10,000 or 1,000,000 lbs. of steam per hour, you can be sure of getting expert refractory recommendations from your B&W Refractories representative. He can show you how to decrease costs and increase furnace life with the proper B&W Refractory for your application. Drop us a postal card to obtain the name of your nearest B&W Refractories Engineer.

HEAVY FIREBRICK—

For oil fired furnaces with flame impringement or spalling or slagging conditions, either *B&W 80* or *Junior Firebrick* can be used. 80's assure uninterrupted service at extremely high ratings. Juniors are recommended where load bearing and temperature requirements are less severe, but too severe for the best grades of fire-clay brick.

INSULATING FIREBRICK—

B&W Insulating Firebrick have the lightest weight and lowest heat conductivity of any insulating firebrick in their class. They store and conduct less heat—withstand direct exposure to furnace gases. Available in six types for temperatures from 1600 F to 2900 F.

PLASTICS—

Used widely for repairs and for forming special shapes *in place*, B&W *Plastic Moldable* and *B&W Plastic Chrome Ore* offer long life under severe conditions. Plastic Moldable is suitable for use in the great majority of furnaces. It withstands temperatures up to 3000 F. Plastic Chrome Ore is ideally suited for severe slagging conditions.

CASTABLES—

In furnaces that require the high resistance of chrome to chemical attack and where speed of installation is important, B&W offers *Kromecast* for temperatures up to 3100 F and *Hydrochrome* for temperatures up to 2800 F.

For burner openings, door linings, walls, roofs and arches, B&W *Kaocast* possesses unusual volume stability and resists spalling. It easily withstands temperatures up to 3000 F.

B&W Baffle Mixes are excellent castables for the construction of monolithic boiler baffles, door linings and other general uses. They are smooth and flow easily, have high strength in small sections. Widely used to withstand temperatures as high as 2600 F.

B&W Insulating Concrete Mixes combine refractoriness, light weight and low heat conductivity with the ability to be poured like ordinary concrete. For temperatures up to 2200 F.

MORTARS—

B&W Mortars—Selecting the right mortar is vitally important to long refractory life, B&W Mortars pay for themselves by saving time in application and by satisfactorily performing their jobs under the designed furnace conditions.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

B-360

B&W REFRACTORIES PRODUCTS—B&W 80 Firebrick • B&W Junior Firebrick • B&W 80 Glass Tank Blocks • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

Doesn't this describe the boiler you want?

- **Designed for industrial load conditions, particularly for plants having small operating and maintenance forces**
- **Offers special design and construction features that assure low annual operating costs**
- **Suitable for a wide choice of fuels and firing**
- **Service-proved in plants similar to yours**

High ratio of radiant heating surfaces . . . fully water-cooled furnace . . . amply insulated steel casing . . . easily accessible tube banks . . . feature after feature of the Vertical-Unit Boiler, Type VU-10, assure top performance with low operating and maintenance costs throughout the lifetime of the equipment. Moreover, because of its symmetrical design every foot of boiler width handles the same amount of water, is swept by the same quantity of gas, and thus absorbs the same amount of heat. This assures uniform steam release, uniform water level across the boiler drum and uniform expansion of pressure parts. It accounts, too, for the ability of the boiler to handle rapid load swings and to produce satisfactory steam quality at all ratings.

The VU-10 is a compact unit, available in sizes which provide capacities from 10,000 to 60,000 lb per hr. Its adaptability to various fuels and methods of firing is emphasized by the fact that the five types of firing illustrated on the opposite page are all applicable to the same general boiler and furnace cross-section. Thus the VU-10 permits you to choose the one *best* method of firing for the fuel and load conditions of your plant.

The Vertical-Unit Boiler has made an outstanding record in meeting the widely varying requirements of plants in virtually every branch of industry. A partial list of the industries that have selected the VU-10 is shown below. The chances are that some plant — or plants — with operating conditions similar to yours are now profiting from VU-10 performance. Let us suggest one in your locality where you can make your own check.

B-399

PARTIAL LIST OF INDUSTRIES THAT HAVE SELECTED THE VU-10 BOILER

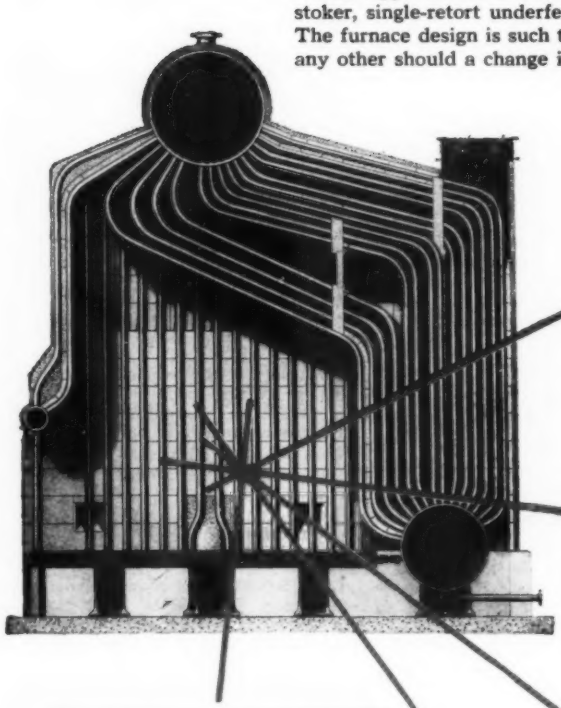
AUTOMOBILE
BAKERIES
BREWERIES
CEMENT
CHEMICAL
COLD STORAGE
DAIRIES
DISTILLERIES
FOOD
GLASS
HOSIERY
HOSPITALS
INSTITUTIONS
LAUNDRIES
LEATHER
LINOLEUM
MACHINERY
METALS
OIL
PACKING
PAINT
PAPER
RAILROADS
RUBBER
SCHOOLS
STEEL
SUGAR
TEXTILE
TOBACCO
UTILITY

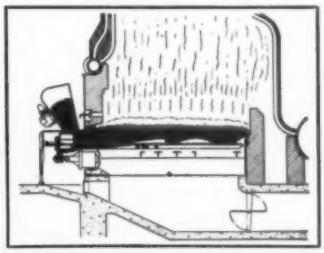
COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

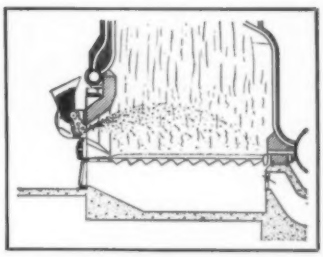
For every fuel market and every type of load there is *one best* method of firing. The selection of that *one best* method for the fuel and load conditions of a particular plant calls for judgment based on broad experience and free from any incentive to favor one type of equipment over another.

The Type VU-10 Boiler is designed for five methods of firing—spreader stoker, single-retort underfeed stoker, chain grate stoker, oil or gas burners. The furnace design is such that any of these methods may be substituted for any other should a change in the fuel market make it advantageous.

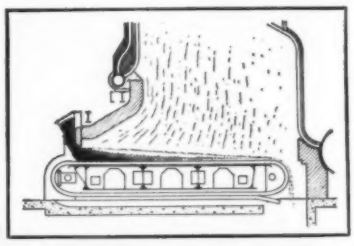




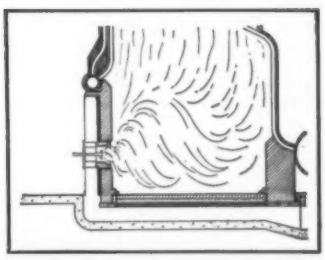
TYPE E UNDERFEED STOKER



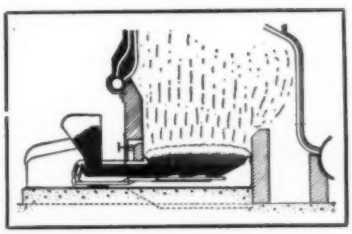
SPREADER STOKER



CHAIN GRATE STOKER



OIL OR GAS BURNERS



C-E Vertical-Unit Boiler

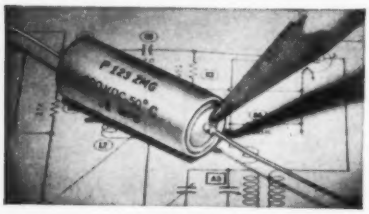
TYPE VU-10

C-E SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

(Continued from page 12)

Corp. The marked size reduction is attained primarily by the metallized-paper section, Hyvol K or M, impregnated and placed in a non-magnetic hermetically-sealed metal case with vitrified ceramic terminal seals. Operating temperatures range from -55C to +50 C without derating, and at ambient

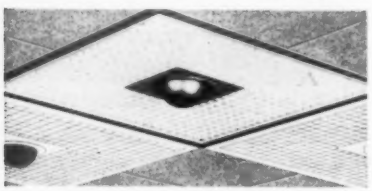


temperatures up to 95 C with voltage reduction. Power factor is less than 1% when measured at or referred to a frequency of 1000 cps and an ambient temperature of 25 C. Other specifications are for extra-severe-service applications.

Capacitors are available in 200, 400 and 600 v d-c, and capacitance values of .0005 to 2.0 mfd. Dimensions range from 1.75 in. diameter by 7/16 in. long, up to .670 in. diameter by 2-7/32 in. long. These bare metal-can units may also be had with plastic insulating sleeves, adding .062 in. to the diameter and 1/16 in. to length.

317—CEILING UNIT IMPROVES INCANDESCENT LIGHTING

The advantages of incandescent plus the modern appearance of fluorescent lighting has been announced by Silvray Lighting,



Inc., for their Skylike fixtures. Graybar Electric Co. is the exclusive distributor.

An adaptation of silvered-bowl incandescent lighting, Skylike is designed for commercial use. In addition to its different and better illumination, it has the advantages of simple wiring, light weight, fast installation, freedom from service call-backs, and lower cost.

High light output comes from utilization of reflected light and provides an even distribution of comfortable full-spectrum light. There are no sharp shadows, the 90-degree shielding prevents both direct and reflected glare, and there is a complete absence of flickering, blinking and hum. The output can be varied from 2,500 to nearly 10,000 lumens per unit by use of 150, 200, or 300 w lamps. The silvered reflector is permanently sealed, and there is no light loss from depreciated ceilings, because the unit carries its own reflection ceiling.

Units are 24 x 24 in. and can be recessed in lines, in threes, in checkerboard arrangement, or surface-mounted.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

318—ATTACHMENTS EXPAND USE OF PULLERS

Addition of several new PROTO puller items, has been announced by the Plomb Tool Co. Separator-puller plate No. 4032 has flat surfaces and knife-like edges that permit insertion behind many bearings and gears where space is too limited for heavy puller hooks, and it thereby protects expensive bearings. The step plate adapters fit into the ends of hollow shafting or housings and provide a base for a puller screw when forcing off bushings, gears and pulleys. They are useful also for installing oil seals. The fourteen sizes range from ¾ and 1 in. diameters to 2-3/8 and 2⅞ in. diameters.

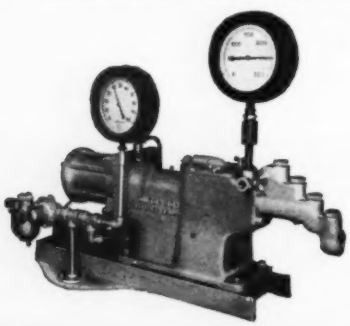
No. 4057J is a new reversible slide-hammer puller jaw, featuring a 2 in. inside reach and a 2½ in. outside spread. Another

slide-hammer puller jaw, No. 4058 J. is designed to pull fly-wheel pilot and other bearings with bores down to ⅝ in. and depths of 1 in. or less.

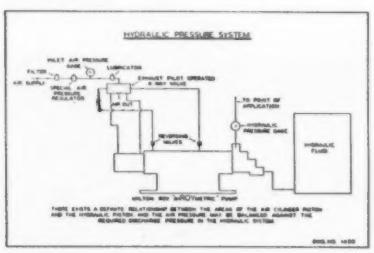
Two more detachable puller screw tips with live centers have been developed—No. 4022TS, a small-diameter type for light and medium-duty pullers, and No. 4001ST, a wheel puller type with a large bearing area to protect axles.

319—AIR-HYDRAULIC PUMP FOR TEST PRESSURES

For testing boilers, pressure vessels, pipe and piping systems, shell and other hollow forgings, vacuum pumps, vacuum valves, chambers and dryers, also for calibrating and testing pressure gages and many other hydrostatic test purposes, at pressures up to 25,000 psi, the Milton Roy Co. announces the "aiROYmetric" pump. It is powered by simple air cylinders with reciprocating pistons. Air cylinder diameters are from 2 to 14 in. with pump plunger diameters from 5/16 to 3½ in. Maximum pressures are obtained by powering small plungers with large air cylinders. Maximum capacities, up to 405 gph, at lower pressures are secured by powering larger diameter plungers by large diameter air cylinders.

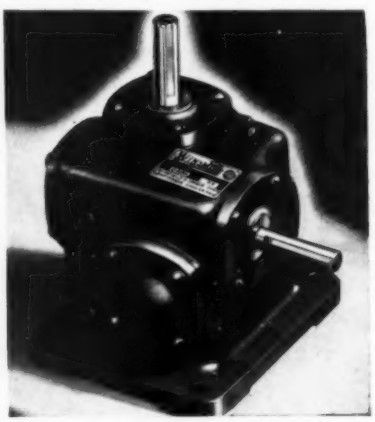


Pump is operated at full stroke length and maximum strokes per minute until the predetermined hydraulic pressure in the system is approached. Then the pump automatically slows down to the speed necessary to maintain the required hydraulic pressure in the system.



320—SPEED REDUCER MADE FOR SMALLER RATINGS

For fractional horsepower, small space requirements, Winfield H. Smith Corp. is now producing a new double reduction speed reducer, designated Type DBRA. It



is designed for a multitude of duties in the transmission of small power loads, and is stocked in 24 different right-angle-drive assemblies.

Totally enclosed in a single piece, compact housing, the low cost DBRA offers a range of 1/20 to ⅛ hp and reduction ratios of 25:1 to 1764:1. This range of speed and power eliminates the necessity of larger speed reducers that include hp ratings 50—100 times greater than required.

321—ILLUMINATION METER RECORDS LIGHT VALUES

Rapid fluctuations in illumination intensity are accurately charted by a new photoelectric light recorder introduced by the Weston Electrical Instrument Corp. The instrument lends itself to many applications

(Continued on page 18)

A Lubricant that Works from sub 0 to 3000 plus

ORDINARY lubricants gum up at extremely low temperatures or break down at extremely high temperatures . . . but not Acheson's specially processed **"dag"** colloidal graphite!

This versatile material is dispersed in organic and inorganic carriers for positive transmission to the zone of lubrication . . . for effective concentration at those points . . . for friction-fighting that can't be beat!

"dag" colloidal graphite is unique in its *combination* of properties and uses. When it comes to slipperiness it is in a class by itself . . . perfect for assembly and run-in, for permanent lubrication of inaccessible parts. It is relatively inert . . . supplies solvent-resisting dry films for degreaser conveyors and alkali washers, reduces freezing and galling of closely mated parts.

But these are merely clues to the multitude of known and unknown uses. Get your own ideas . . . get a copy of Bulletin No. 424 on **"dag"** colloidal graphite for industry. If you like, ask to see an Acheson engineer, experienced in finding new and cost-saving ways to solve industrial problems. Fill out coupon and mail.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Bulletin #424

☐ Send an Acheson engineer

NAME.....

COMPANY.....

STREET.....

CITY.....ZONE.....

STATE.....

G-17

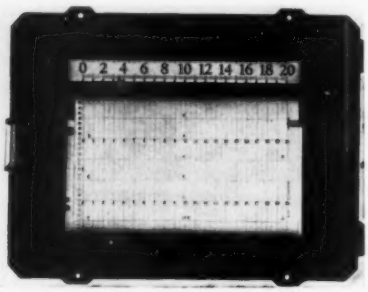
dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan
also Acheson Colloids Limited, London, England

(Continued from page 16)

where wide variations in light intensity must be recorded faster than can be done by hand.

Though a new device, the photoelectric light recorder utilizes principles previously employed in other Weston and Tagliabue instruments. The sensing element, which can be placed wherever convenient, employs



a photoelectric cell of the dry disk type and a built-in "Viscor" filter matches its color response to that of the human eye. Its recorder follows rapid changes without overshooting or hunting.

Full scale values of 20, 40, or 80 fc are selected by a single switch. The recorder can also measure candlepower of any value by proper adjustment of distance from the light source.

322—GEARED MOTORS ARE SPLASH PROOF

Sterling Electric Motors, Inc. has announced that their Slo-Speed geared electric power drives are now available in the "Splash-Proof" design for horizontal floor mounting, ideally suited for locations which are subject to direct streams of water or other liquids.

These motors are built with single or double reduction gears, providing speeds from 780 down to 20 rpm, in ratings ¼ to 15 hp inclusive. One piece cast-iron

stator frames and one piece cast end bells with integral baffles—(no loose shields or deflectors) provide protection in all kinds of industrial plants, especially in creameries, canneries and chemical processing.

This end-bell design permits free passage of ventilating air through the motor and prevents splashing liquids reaching the interior of the motor. Seals are incorporated on shaft ends, assuring positive protection against entry of liquids into the bearing housings.

323—ELECTRICAL METERS FEATURE PORTABILITY

Portable instruments, designated Type P-12, are available from the Westinghouse Electric Corp. Rated in the 2% accuracy class, the line utilizes both moving-iron and permanent-magnet moving-coil mechanisms in a compact molded case.

Included are single and multiple range

models. Ammeters are available in full-scale ranges from 20 microamp to 50 amp d-c, and from 5 ma to 50 amp a-c. For d-c voltages, the full-scale ranges run from 10 mv to 800 v, with a-c ranges from 1.5 to 300 v. Rectifier milliammeters are available in full-scale ranges from 0.5 to 10 ma, and rectifier voltmeters from two to 800 v.

The outline dimensions of the meter are: 3-5/16 in. wide, 4¼ in. long, and 1-25/32 in. deep for the d-c type. The a-c meter is the same size, except that the depth is 2-5/16 in.

The complete line is magnetically shielded to permit use of the instruments on both magnetic and non-magnetic surfaces, and spaced as closely together as is required.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

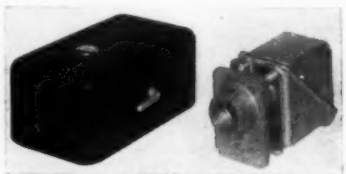
324—OIL AND GAS FLAMES SAFEGUARDED

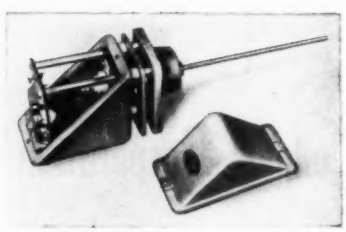
Combustion Control Corp. introduces the flame failure safeguard systems FF-3 and FF-6. FF-3 is photoelectric protection of manually ignited and semi-automatic industrial oil burners. This equipment is an electronic safeguard which actually "sees" the oil flame. When flame fails, the apparatus instantly cuts off fuel and can be wired to sound an alarm.

System FF-3 consists of scanner type 45PH5 and control type 24QJ5. The scanner contains the entire electronic system, and is located on the burner mounting plate in such a way that it has a clear view of the oil flame. The control contains power supply and relay system. Power relays are located with contacts readily accessible for cleaning. Flame relay is sealed for unlimited life. Plug-in feature simplifies replacement. Failure of vacuum tube or phototube in monitoring units causes instantaneous safety lockout of burner. Electrical interlock prevents starting of burner, if flame relay sticks closed.

Supply voltage is 115/230 v, 60 cycles at 20 va with a load rating of 1 hp; plus 125 va pilot duty at 115 or 230 v. Ambient temperature range is 32-125 F.

System FF-6 for gas burners includes electronic flame rod type 45JQ1 and the same control. The flame rod is mounted near the gas pilot on the burner plate and projects into the fire chamber. The rod is so located that its tip impinges on the pilot or main gas flame and actually "feels" the gas flame. Specifications are the same as for the FF-3 system.





325—800-F BEARINGS ARE SELF-LUBRICATED

Carbon bearings offered by Morganite, Inc., operate efficiently at temperatures up to 800 F without lubrication. Ability to function at high speeds under heavy loads makes them particularly well adapted to steam pumps, turbines, industrial ovens, and in installations where inaccessibility of bearings makes maintenance difficult and costly. Other important advantages include resistance to corrosion and chemical attack, with high mechanical strength. The self lubricating material is applicable to seals, rings, slides and valves.

326—HOT PLATE HAS BUILT-IN CONTROL

Introduced by the Central Scientific Co., the thermostatic heat control built into their No. 16633 laboratory hot plate makes it a convenient device for maintaining liquids at approximately predetermined temperatures from 150 600 F. The heating

source is cast into the 6-in. diameter iron top. The body is stainless steel. The unit operates on 115 v with a power demand of 500 w.

327—CHRONOMETER COMBINED WITH RPM COUNTER

Chronometric tachometer, guaranteed to have an accuracy of .01%, is a Technical Oil Tool Corp. product and is a combined chronometer and revolution counter, as well as a surface speed indicator. When the operator presses the tip into the shaft to be measured, the tachometer and shaft start turning at the same speed. The timing release button is then pressed, setting the hands to zero. When the button is released,

(Continued on page 122)

COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 187 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have).

NEW

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BULLETINS

BOILERS, AUXILIARIES, ACCESSORIES

Boiler Return Systems (A). Sixteen page three-color catalog illustrates and describes standard and special type boiler-return systems. Applications, descriptive data and specifications are included, as well as an analysis: "What to look for when buying a return system." Fred H. Schaub Engineering Co.

Refractories (B). Intermediate and high-heat-duty fire brick is the subject of a bulletin just released. Properties are detailed and general characteristics and uses are specified. Information on the facilities for the production of special fire clay shapes to meet practically every requirement is included. Walsh Refractories Corp.

Stokers (C). Folder describes and illustrates various stoker models adaptable to any type or make of boiler or steam generator including package types. Gives typical 24-hr flow chart and sketches of installations. Detroit Stoker Co.

Economizers (D). New 6-page catalog covers cast-iron and steel tube economizers. The advantages of diamond shaped tubes and the streamlined flow of gas and soot-blower steam are discussed. Tube arrangement makes the entire outside surface of each tube visible during inspection. Green Fuel Economizer Co.

Refractory Concrete (E). Revised booklet on refractory and heat-resistant concrete gives latest available information on "how-to-do-it." You can select proper types of refractory concrete for a wide range of temperature and insulating conditions from the tables contained in this 24-page publication. Lumnite Div. Universal Atlas Cement Co.

Surface Condensers (F). With chapters on condenser design, installation of condenser tubes and construction of various types and sizes, this bulletin is well illustrated by cross sections, photographs and drawings on surface condensers and auxiliaries. Circulating pumps, vertical turbine pumps, steam-jet ejectors, and thermostatic control are also carefully treated. Worthington Pump and Machinery Corp.

Refractory Coating (G). Instructive 4-page bulletin describes a new method of coating refractories with a ceramic-metallic compound for protection against slag penetration, abrasive wear, flame erosion, corrosive gases, molten metal and thermal shock. Contains sketches of test methods and will answer most questions regarding this new method. Cera-Kote, Inc.

Heat Transfer (H). House organ outlines the many different types of heat transfer apparatus manufactured by this company for power plants. Descriptions and illustrations cover boiler feedwater evaporators and heaters, oil and water coolers, heaters for fuel oil and storage tanks, and generator air coolers. The Griscom-Russell Co.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Dual-Fuel Diesel (I). Illustrated 8-page bulletin describes various power applications of this four-cycle, 16-in. engine that operates on gas fuel with pilot oil, on oil fuel or on proportions of either. Engine can also be adapted to burn sewage gas. Shows by a schematic sketch and simple directions, the operation of the engine and the ease of immediate changeover in fuel. Nordberg Manufacturing Co.

Stationary Engines (J). Folder on dual-fuel engines describes latest improvements on these emergency power sources. Tells in simple words how to operate these engines that burn natural gas or diesel fuel. Murphy Diesel Co.

Steam Turbine (K). Single stage steam turbine, for high pressure application, is illustrated and thoroughly explained in a colorful four-page bulletin. Specifications and composition of materials are listed for three sizes—600, 1,200, and 2,000 bhp. The DeLaval Steam Turbine Co.

Engine Air Filters (L). Two bulletins contain application and selection data on air filters and their metal holders for air compressor, diesel and gas engine air intake service. Outline dimension sheets and specifications are included. American Air Filter Co., Inc.

Engine Intake Silencer (M). Bulletin contains information on nine sizes of an oil bath air cleaner and intake silencer for combustion engines and air compressors. Operational features are explained—both with text material and cross-sectional flow diagrams. Capacity, selection and dimension tables are listed. American Air Filter Co., Inc.

Air Compressors (N). Colorful 18-page bulletin contains numerous photographs of featured items of this company's two stage air compressor. Cross sectional views show the air flow in color. The lubrication system specifications and dimensions are covered for three sizes: 7 in. stroke, 125 to 150 hp; 8½ in. stroke, 200 to 250 hp; and 10 in. stroke 300 to 350 hp. Discharge pressure ranges between 80 and 125 psi. Ingersoll-Rand Co.

Portable Air Compressor (O). Folder covers all features of a compact portable air compressor. Cross sectional drawings are captioned, with colored arrows leading to important parts of the compressor. Specifications are listed for the compressor and engine, with table on number of tools operated. Accessories and their application are included. Worthington Pump & Machinery Corp.

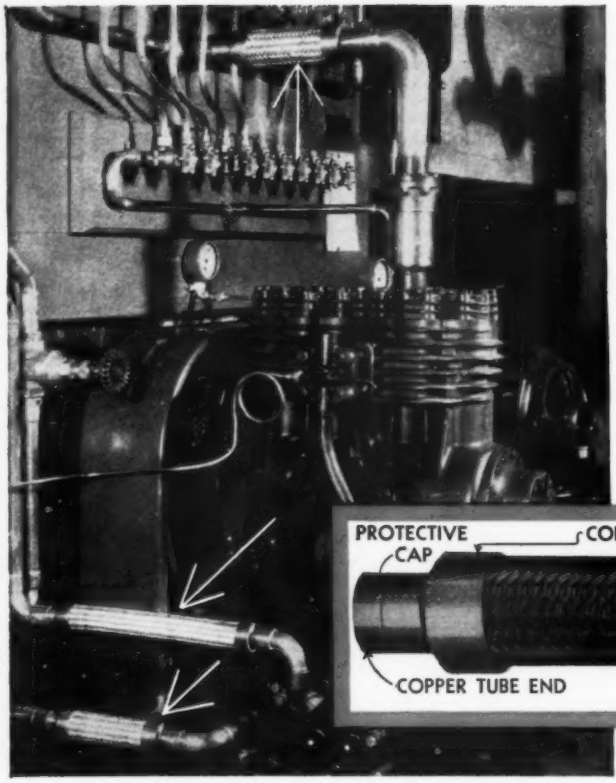
WATER AND LIQUID TREATMENT

Embrittlement (P). Highly informative bulletin titled "Embrittlement—Current Status . . . its causes and control" is a 3-page discussion on the problem of embrittlement. Tells how to distinguish between steam boiler cracks caused by corrosion-fatigue and embrittlement; explains the prevailing conditions that cause intercrystalline cracking of boiler metal, and describes recent developments including the use of the embrittlement detector unit. Allis-Chalmers Mfg. Co.

Fuel-Oil and Sludge Treatment (Q). Illustrated folder and 7-page bulletin contain information for preventing and correcting unsatisfactory conditions in the storing, handling, pumping, heating and burning of industrial fuel oil. Sludge prevention is a major topic of these publications which also contain drawings, graph of a 50-day test and photo of testing equipment. E. F. Drew and Co., Inc.

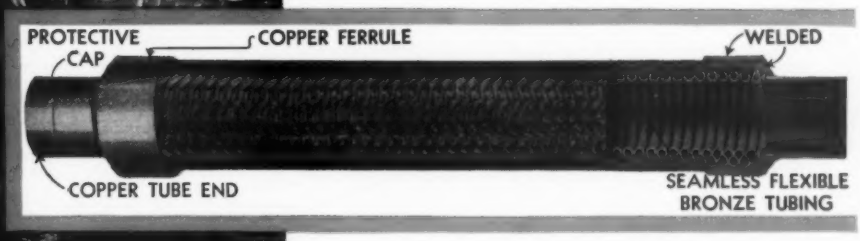
Corrosion Control (R). Folder entitled "Calgon Controls Corrosion" de-

(Continued on page 22)



it's the sign of

a vibration-free job . . .



it's an *American* Vibration Eliminator

COMPRESSOR VIBRATION and noise is muffled plenty in a line equipped with an American Vibration Eliminator. What's more, the line that absorbs vibration is far less apt to fail from fatigue.

An American Vibration Eliminator is the finest product of its kind. The corrugated bronze tubing is *seamless*. Copper ferrules and tube ends are *bronze welded*. Each unit is pressure-tested under water, is spotlessly clean and dry, with ends firmly sealed. Individual packages are clearly marked. You get the best when you buy "American."

It's also the best refrigeration engineering practice to use ANACONDA Copper Refrigeration Tube. This uniformly soft copper tubing that bends and flares easily is mirror-smooth with a clean, bright interior that makes solid seats. It's dehydrated even beyond A. S. R. E. requirements; cup-sealed for complete protection and minimum waste.

Your jobber handles American Vibration Eliminators and ANACONDA *Copper Refrigeration Tube. Ask him about them today. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

B6123

For dependability . . . use ANACONDA®

REFRIGERATION TUBE *and*

AMERICAN VIBRATION ELIMINATORS

(Continued from page 20)

scribes and illustrates the protection of industrial, commercial and municipal water systems against general corrosive attack. Controlling corrosion of hot water systems and industrial cooling systems is discussed, as well as the elimination of "red water." Calgon Inc.

Feedwater Treatment (S). Two-color bulletin contains 20 pages of descriptive data on zeolite and chemical type water softeners, demineralizing equipment and silica removal equipment. Another bulletin comprises five types of total demineralizing, three of partial demineralizing and various types of degasifying apparatus. Considerable information on silica removal by ion exchange is included. Hungerford & Terry, Inc.

Water Conditioner (T). Bulletin describes a two-stage softener in which the first stage is the hot process, using lime or dolomitic lime, followed by the zeolite softener, which reduces the residual hardness to zero. Cochrane Corp.

Water Purification (U). Revised 16-page bulletin gives complete engineering data, specifications and capacity tables for three types of circular collectors for the clarification of sewage, industrial waste water and water purification. Featured components of the system are thoroughly explained and illustrated. Ralph B. Carter Co.

Water Hardness Test (V). New literature describes method for determining water hardness. The precision and range of adaptability extend from softened waters with less than 1 ppm of total hardness to those having concentrations comparable to sea water. Only the hardness indicator, a standard acetate solution (N/50) and a buffer solution are required to make the test. Allis-Chalmers Mfg. Co.

Water Conditioner (W). Descriptive four-page report tells how a chemical conditioner will "make water wetter" so it penetrates hard-to-dissolve materials. Many applications are covered. Removal of such items as oil, glue, resinous deposits, grease, slime, algae and grime is explained in detail. Service Industries.

Evaporation Losses (X). Report entitled "Evaporation Losses from Cone Roof Tanks" offers data that will help engineers solve problems involving liquid storage. Three main topics are covered: evaporation losses, breathing losses, and filling losses. Graver Tank & Mfg. Co., Inc.

ELECTRIC EQUIPMENT

Lighting (Y). "Your Lighting Simplified" is the title of a new 10-page booklet that explains all about lighting layout, installation, equipment and maintenance. The Edwin F. Guth Co.

Electrical Enclosures (Z). Profusely illustrated 16-page booklet tells a picture story of the many items fabricated by this manufacturer of sheet metal electrical enclosures. Control desks, cubicles, electrical cabinets, power distribution and control panels, switchgear housings and many other large and small items are pictorially presented. The Kirk & Blum Manufacturing Co.

Outdoor Bus Ducts (2A). "To Whom It May Concern" letter written to this company's field engineers tells about outdoor bus duct that has received Underwriters Laboratories approval. Design features are a major subject. BullDog Electric Products Co.

Underfloor System (2B). Manufacturer of steel underfloor electrical raceway systems has published a 36-page four-color catalog which provides, among other things, a complete suggested specification for a floor electrical distribution system. Other pages are devoted to drawings, specifications and photos of the component parts of the system. Roughing-in dimensions are provided, as are material catalog numbers. National Electric Products Corp.

Polyphase Motors (2C). Bulletin (10-pages) on polyphase electric motors, describes one to 75-hp horizontal motors, illustrating construction details in cross section and cutaway views. Some of the features described are insulation, bearings, ventilation, mounting, service, frames and end bells, rotors and machining. A. O. Smith Corp., Motor Div.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

Squirrel-Cage Motors (2D). Fully illustrated, this folder describes the construction and assembly details of squirrel-cage motors. Also gives speed-torque curves at varying full-torque percentages for three different types of these drip-proof motors—½ to 600 hp. Star-Kimble Electric Co.

D-c Motors (2E). Bulletin, that contains four pages, covers d-c motors rated at 250 to 6000 hp, for high and low speed and for direct, belt, or gear drive. Construction features are illustrated and discussed. A page is devoted to mechanical modifications, such as enclosed models and low-inertia mill type motors. Elliott Co.

Circuit Transformers (2F). A handy ordering table is included in a four-page folder on power circuit transformers. Transformers from 50 to 15,000 va capacity are conveniently cataloged. A typical wiring diagram showing the use of higher voltage circuits is also included. Jefferson Electric Co.

Electrical Maintenance (2G). Booklet entitled "Care of A-C Rotating Equipment" is broken down into preventive maintenance and machine repairs. Such subjects as drying moist insulation, measuring insulation resistance, bearing clearances and proper machine applications are covered. Machine repair section includes information on stator coil and slip ring rotor repairs and balancing of rotating equipment. Allis-Chalmers Mfg. Co.

D-c Generators (2H). Bulletin describes an expanded line of d-c generators for lighting and power services. Specifications and featured construction specialties are included for all sizes which range from 10 to 1,500 kw units. The Electric Products Company.

INSTRUMENTS, CONTROLS, RECORDERS

High-Range Insulation Tester (2J). Complete information on a new high-range insulation tester is available in a 24-page bulletin. Higher and wider ranges—up to 50,000 megohms, 2,500 v d-c—of this new instrument are discussed together with typical cases of its application in the field of preventive maintenance. James G. Biddle Co.

Portable Insulation Tester (2K). Literature on a new small, portable hand crank insulation tester gives a complete description of this 4-lb 14-oz instrument. In addition, it contains specifications and a schematic diagram of the tester. Herman H. Sticht Co., Inc.

Counting and Timing (2L). Bulletin (4 pages) describes a mechanical recorder which may be actuated by nearly any operation, from punch press to nuclear reaction, that may be provided with an electrical impulse. Units as low as 1/100 min and intervals up to 1,000 min are handled. Complete specifications and some applications are given. Streeter-Amet Co.

Temperature Regulator (2M). Self-operating regulator, combining valve and thermostatic bulb in one unit is described in 7-page bulletin, with engineering information on applications, pressure drops, capacities and temperature ranges to 450 F. Useful in most cases where temperature controlled liquids are used. Powers Regulator Co.

Engine Indicator (2N). Instrument for recording the complete pressure-time diagram of even high speed engines is described in leaflet. Portability and wide range of the instrument permit a convenient study of the pressure events under consideration. Bacharach Industrial Instrument Co.

Flowmeters (2P). Data booklet, 32 pages, fully illustrates and explains flow measurement problems and their solution. Meter bodies, differential devices and reading instruments are described and a special section is included on a wide range and reverse flow. Republic Flow Meters Co.

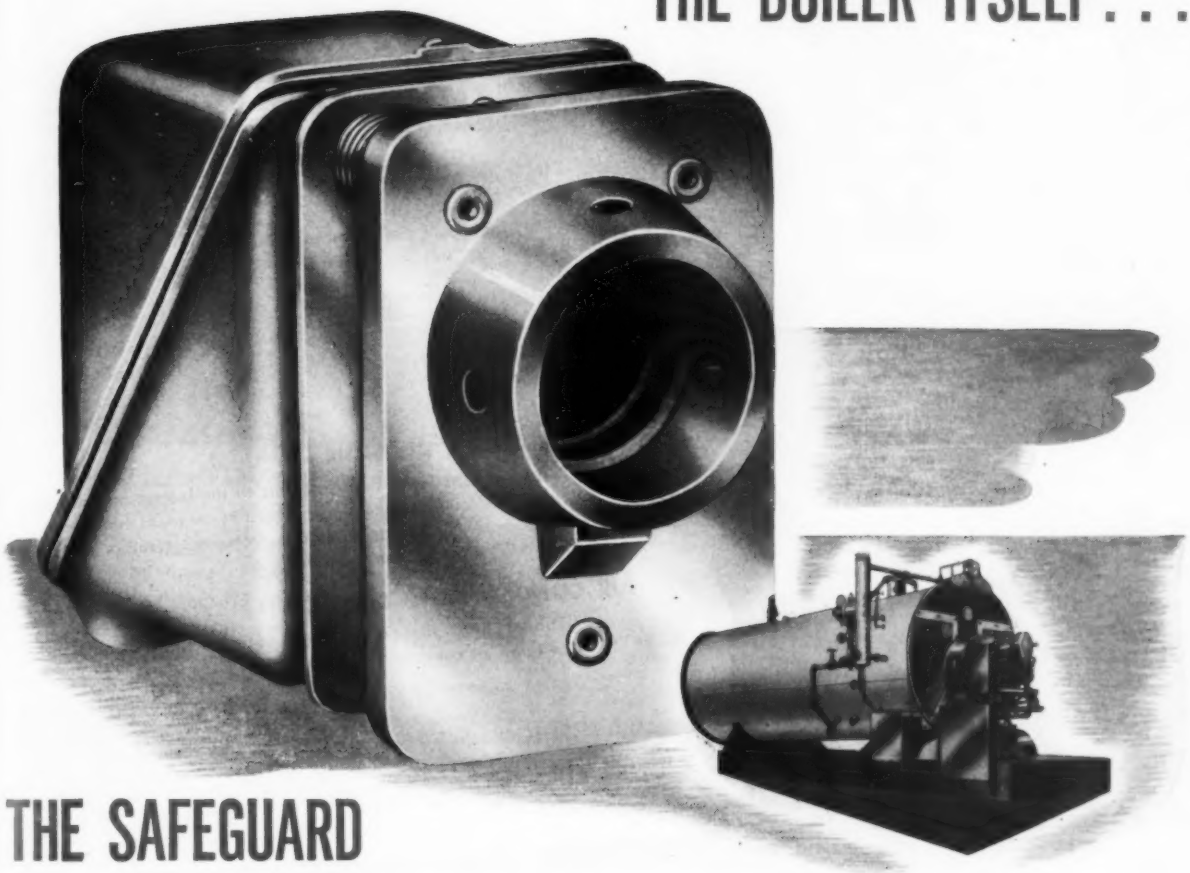
Recording Thermometers (2Q). Liquid-filled, vapor pressure, and gas-filled thermometers for recording, indicating, controlling and telemetering are the subject of a new 44-page, descriptive and illustrative bulletin. Information on operating principles, characteristics of operation, temperature sensitive bulbs, recording charts and accessories is given, in addition to reproductions of actual temperature chart records and sketches of applications. The Bristol Co.

Pressure Differential Meter (2R). Bulletin (4 pages) describes instrument for reading pressure differentials from 50 in. water to 150 psi at pressures up to 2,500 psi. Applications for measuring pressure drop in steam, gas and liquid flow are discussed and diagrams fully illustrate operating principles. Hagan Corp.

Watthour Meter Evaluator (2S). Evaluator is an aid in determining the economic point to retire older watthour meters. It is fully described and an-

(Continued on page 130)

MORE IMPORTANT THAN THE BOILER ITSELF . . .



THE SAFEGUARD THAT PROTECTS IT

FACTORY MUTUAL FM APPROVED UL

*W*here the safety of personnel and property are vital, and where uninterrupted plant operation must be assured; Fireye Flame Failure Safeguards are certain to be specified.

Fireye insures complete flame failure protection because it is photo-electric . . . it sees the flame . . . and if flame fails, Fireye acts with the speed of light to cut off the supply of fuel *before* dangerous gases accumulate in the combustion chamber.

Controls which do not react instantly can not provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction.

Fireye more than meets the exacting requirements of all insurance laboratories for the protection of *all* classes of oil and gas burners . . . that is why Fireye is standard with leading burner manufacturers.

To insure complete protection for your plant and personnel, write for Bulletin 604-C.

fireye

COMBUSTION CONTROL CORP.

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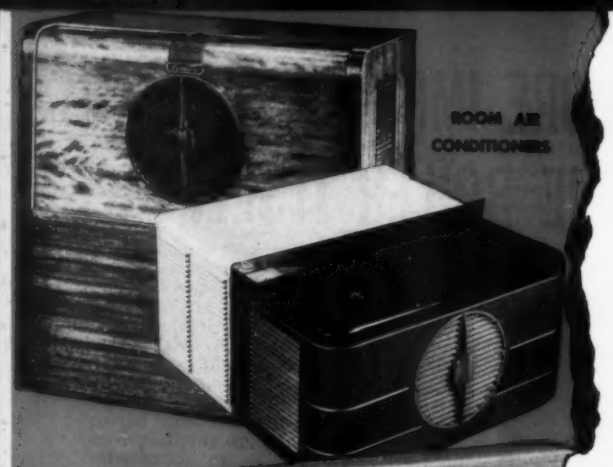
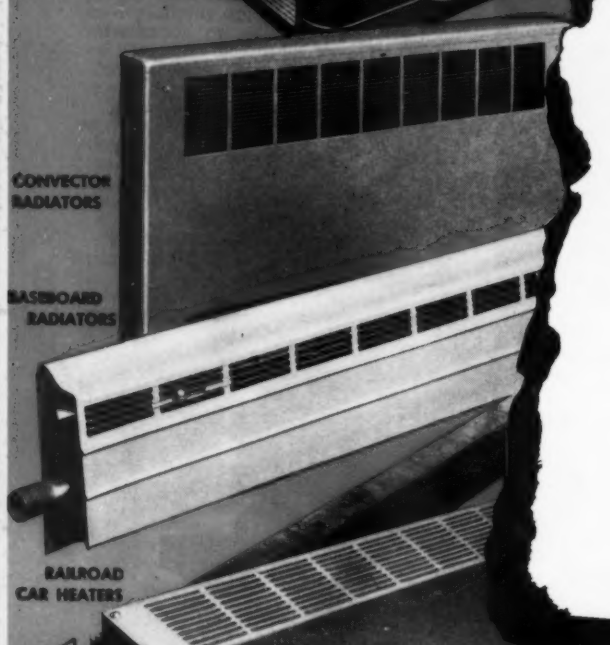




YOU HAVE SOMETHING Extra TO SELL WHEN YOU SELL

fedders
A Great Name Since 1896

HEAT TRANSFER EXPERIENCE

HEATING DIVISION

Did you know that the Fedders Heating Division is rapidly becoming one of the largest manufacturers of heating products for home and industry?

AUTOMOTIVE DIVISION

Did you know that in addition to a constantly increasing line of heating equipment, Fedders has built millions of automobile radiators and car heater cores for standard equipment on America's fine automobiles and trucks?

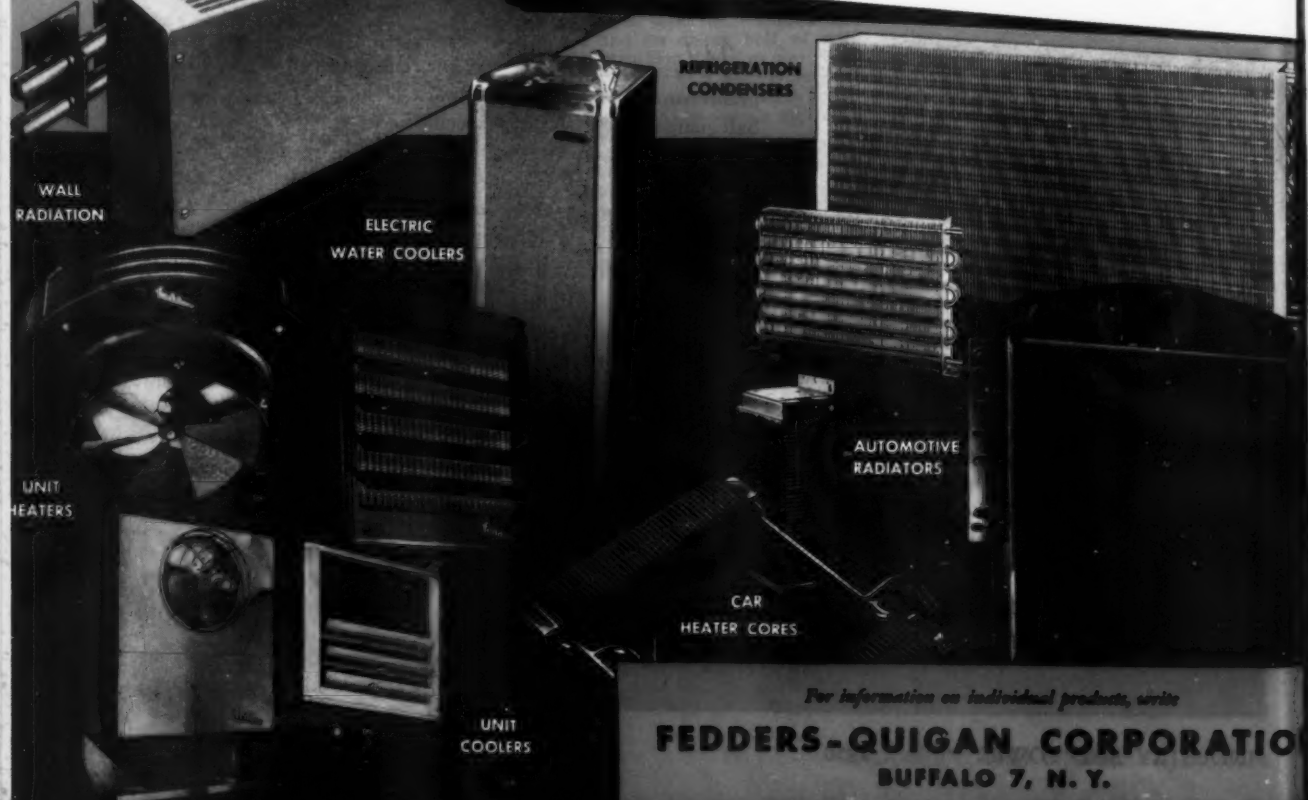
REFRIGERATION DIVISION

Did you know that Fedders is one of the largest manufacturers of air cooled finned condensers used as standard equipment on household, commercial and quick freeze refrigerators as well as air conditioning units?

AIR CONDITIONING DIVISION

Did you know that Fedders is one of the foremost manufacturers of room air conditioning units?

This all adds up to an engineering background responsible for Fedders performance. Today, more than ever before, men who specify, sell, install and use heating equipment look to Fedders for the best.



For information on individual products, write

FEDDERS-QUIGAN CORPORATIO

BUFFALO 7, N. Y.

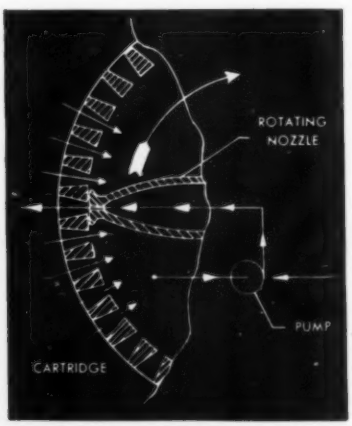
Save Water Automatically

and save money, too!

If water's scarce in your community, here's a painless way to cut down consumption.

If water isn't scarce yet, it's still expensive (particularly if you have to heat it or treat it), and here's an easy way to cut down its cost.

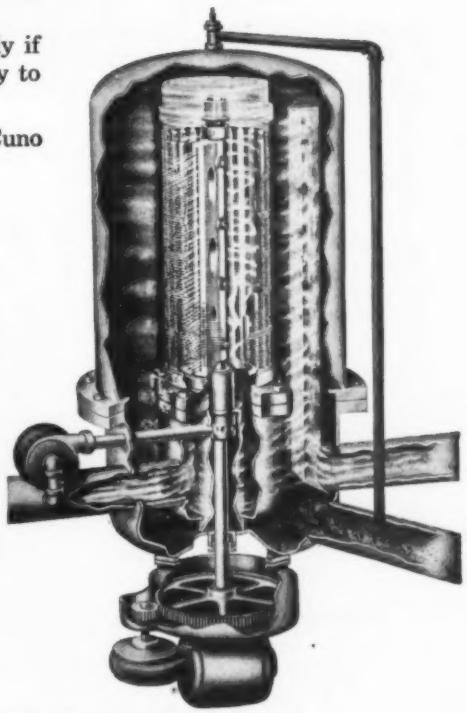
Make dirty water *fit for use* and *re-use* with a Cuno FLO-KLEAN Strainer.



Permanent, Resists Abrasion and Corrosion

Cuno Flo-Klean Filter makes raw water suitable for many plant services . . . keeps recirculated water clean . . . *pays for itself in as short a time as a year.* Permanent wire-wound cartridge positively removes all solids larger than spacing specified.* Pressure drop is exceptionally low because fluid moves in a straight line, encountering only momentary restriction.

**Available spacing from .0025 in. to .020 in.*



Continuously self-cleaning without fluid waste

There is no loss of backwash fluid. Used backwash is returned to the system. With no interruption of flow for cleaning the strainer, no duplex installation is needed. Operation, including sludge removal, may be completely automatic.

No Fluid Is Better Than Its Filtration

CUNO

Complete Line Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

MICRONIC (MICRO-KLEAN) DISC-TYPE (AUTO-KLEAN) WIRE-WOUND (FLO-KLEAN)

Find Out How to Save Money

cleaning any fluids containing abrasives

CUNO ENGINEERING CORPORATION
149 South Vine St., Meriden, Conn.

Please send information—without obligation—on Cuno FLO-KLEAN for application noted:

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Name.....Title.....
Company.....
Address.....
City.....State.....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 137. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Get complete information by sending for the latest Powermaster Catalog. Orr & Sembower, Inc.

2—See page 46. Steam Generator: Write for more data on the Union "H" Type Steam generator—steel cased boiler with superheater, dust collector, air heater, ducts, fans, and stacks out-of-doors. Union Iron Works.

3—See page 132. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

4—See page 39. Packaged Steam Generators: New fully illustrated Catalog 202 gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

5—See page 141. Packaged Steam Boilers: Send coupon for full information on complete line of packaged steam boilers—fully automatic, 60 to 500 hp plus ample overload. Johnston Brothers, Inc.

6—See page 11. Water Tube Boilers: Write for catalog fully describing Wickes Type-A Water Tube Boilers. Their designed to increase efficiency through greater heat, absorption; maintain high operating efficiency, insure fast, smooth water circulation. Wickes Boiler Company.

WATER TREATMENT

7—See page 149. Santobrite Algaecide: Maintains cooling tower efficiency by preventing sluggishness and obstructions in the circulating system. No special equipment is required. Send for Bulletin 0-15. Monsanto Chemical Company.

8—See page 143. New Versene Test Kit: Enables you to test the hardness of water in your plant in less than two minutes. As easy as telling red from blue and is accurate within one grain of hardness per gallon. Packaged in special sturdy pocket-size plastic box. Includes enough chemical to make more than fifty separate tests. Refills available, full directions in each kit. Price is $3.00, postpaid on a money-back basis. The Bersworth Chemical Company.

9—See page 25. Cuno Flo-Klean Filter: Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in as short a time as a year. See page 25 for coupon which offers complete information without obligation on Cuno Flo-Klean for your particular application. Cuno Engineering Corporation.

CLEANERS AND BLOWERS

10—See page 139. Combination Blower-Sucion Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

11—See page 133. Vacuum Cleaner: All purpose, two-sweeper portable Hoffco-Vac $50 is designed specifically for use where large dust accumulations are to be handled. For non-stop cleaning; superior separation. Handles like lighter, smaller machines. Write for Bulletin A-794. U. S. Hoffman Machinery Corporation.

COMPRESSORS

12—See page 119. Motor Driven Compressors: Write for Bulletin 4910 which contains full details and operating data on Schramm's complete line of motor driven compressors. You're sure to find the right combination for your job. Schramm, Inc.

DIESEL POWER

13—See page 69. Diesels for All Horsepower Requirements: Complete information available on request for engines ranging from 120 to 1750 hp, straight Diesels or dual fuel, normally aspirated or supercharged. Chicago Pneumatic Tool Co.

14—See page 59. Dual-Fuel Engines: Push-button control permits the switch from oil to gas or gas to oil instantly. Supercharged and non-supercharged models range from 170 to 1500 hp. Fully illustrated booklet on request. Superior Engine Division, National Supply Company.

DUST & FLY ASH COLLECTING EQUIPMENT

15—See page 54. Electrical Precipitation: Write for your free copy of an informative booklet which presents full information on the Cottrell Precipitator. It effectively cleans stock gases by removing over 95% of all fly ash particles. Research Corporation.

16—See page 123. Dust Control: Write for information on how dust control equipment can create better working conditions that result in more production and lower costs. Dracco Corporation.

TO GET YOUR FREE COPIES OF THIS NEW LITERATURE CIRCLE THE CORRESPONDING NUMBERS ON ONE OF THE CONVENIENT POST CARDS ON PAGE 37. MAIL A CARD TODAY. NO POSTAGE NECESSARY.

17—See page 45. Fuller-Kinyon Pumps: These pumps are now in use in several generating stations for the clean and efficient handling of fly-ash. Consult Fuller about fly-ash conveying. They'll be glad to make a study of your conditions and suggest means to improve them. Fuller Company.

ELECTRICAL EQUIPMENT

18—See page 63. Motor Maintenance Repair: When you have peak periods of rush jobs that push overtime costs to maximum and result in red ink operation, turn to National Electric Coil Company. Write for complete information. National Electric Coil Company.

19—See page 131. Interior Plant Lighting: Make sure your plant interior is properly lighted for maximum employee efficiency. Usually, faulty illumination is result of improper light distribution instead of insufficient quantity. Let Hyre solve your interior lighting problems. Write for full information. Hyre Electric Co.

FLOOR REPAIRS

20—See page 139. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and "Hand Book of Building Maintenance". Flexrock Co.

FUELS AND FIRING EQUIPMENT

21—See pages 28, 29. Vane Control: Easy to operate, for link and lever action, no lubrication, full fan performance—Sturtevant Vane Control is the economical way to obtain variable fan outfit at high efficiency. Combines the advantages of instantaneous regulation to exact pressure and volume requirements with substantial power savings when system does not operate at full rated capacity. Write for full information. Westinghouse Electric Corporation, Sturtevant Division.

22—See page 34. Boiler Baffle Walls: Bulletin BW-44, 18 pages containing valuable useful data on modern Baffle Wall design and construction for all water tube boilers. The Engineer Company.

HEATING, VENTILATING AND AIR CONDITIONING

23—See page 55. Radiant Heaters: Uniform, exact heat when you want it is yours at the turn of a dial when you use Chromalox Electric Radiant Heaters as your heat source for infrared drying, preheating, baking, curing, dehydrating and similar applications. Write for application file on Chromalox Radiant Heaters. Edwin L. Wiegand Company.

24—See page 150. Fans and Blowers: These fans and blowers move more air—yet cut power costs per cubic foot to lowest possible level. Maintenance costs remain at low level year after year. Contact Hartzell representative or write for full information. Hartzell Propeller Fan Co.

(Continued on page 27)

READERS' GUIDE

(Continued from page 26)

25—See page 129. Air Conditioning: Niagara "Controlled Humidity Method" gives complete control of temperature and relative humidity. Provides dry air at normal atmospheric temperatures with little or no refrigeration. Read this informative advertisement then write for additional data. Niagara Blower Company.

26—See page 24. Heating Equipment: Write for full information on room air conditioners, convector radiators, baseboard radiators, railroad car heaters, wall radiation, refrigeration condensers, electric water coolers, unit heaters, unit coolers, car heater cores, automotive radiators—all products of Fedders-Quigan Corporation.

27—See page 33. Unit Heaters: Bulletin HR-5 gives you complete data on revolving Wing heaters. These heaters flood entire heating area with fresh, live, warm air. Outlets move slowly through complete circle. Hot blasts, chilly areas are eliminated. L. J. Wing Mfg. Co.

28—See page 19. Coppus Blowers: For mancooling and removing fumes from confined places, as well as for cooling and drying materials and equipment. Check and mail coupon on page 19 for specific information. Coppus Engineering Corp.

HEAT EXCHANGER

29—See page 42. Refrigeration Condensers: Write for Bulletin RC-1. Pertinent, up-to-the-minute information on this complete line of refrigeration condensers. 21-page booklet showing types and sizes designed to deliver low temperature liquid with the lowest condensing pressure. Henry Vogt Machine Co.

INSTRUMENTS

30—See page 60. Instruments: A few of the many specialized instruments available from Weston are illustrated and described in this advertisement. All are designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. Write for more details. Weston Electrical Instrument Corp.

31—See page 147. Flow Indicators: Write for Bulletin S-1 for specifications of Ernst Sight Flow Indicators. Bulletin also contains details on gage glass guards of nonbreakable plastic, flat gage glasses, caliperated gage glasses, rubber gage glass gaskets, brushes, and glass cutters. Ernst Water Column & Gage Co.

32—See page 142. Recording Mechanical Counter: Permits a complete analysis of efficiency in terms of hours and minutes. Simplifies studying production flow and determining how to maintain high production level. Write for complete information and illustrated circular S C 18. Streeter-Amet Company.

(Continued on page 30)

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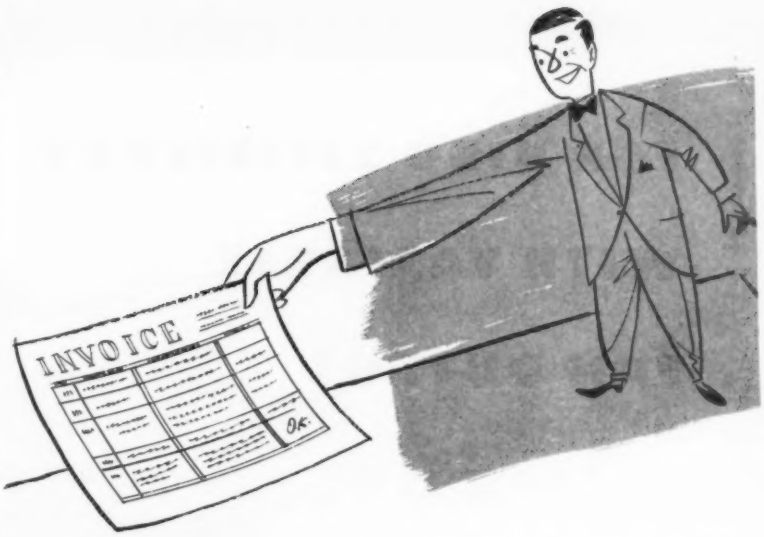

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FOR HIGH EFFICIENCY WITH VARIABLE FAN OUTPUT

THE NEW Sturtevant VANE CONTROL

Sturtevant Vane Control has been universally accepted as the economical way to obtain variable fan output at high efficiency. It combines the advantages of instantaneous regulation of fan output to exact pressure and volume requirements with substantial power savings during those periods when the system does not operate at full rated capacity.

Easily Operable—Vane Control is a simple mechanism which remains easily operable under hot and cold conditions. Notice in the illustration how a cast-iron closure which fastens to the cone of the inlet box completely shrouds the center mechanism from the gas stream.

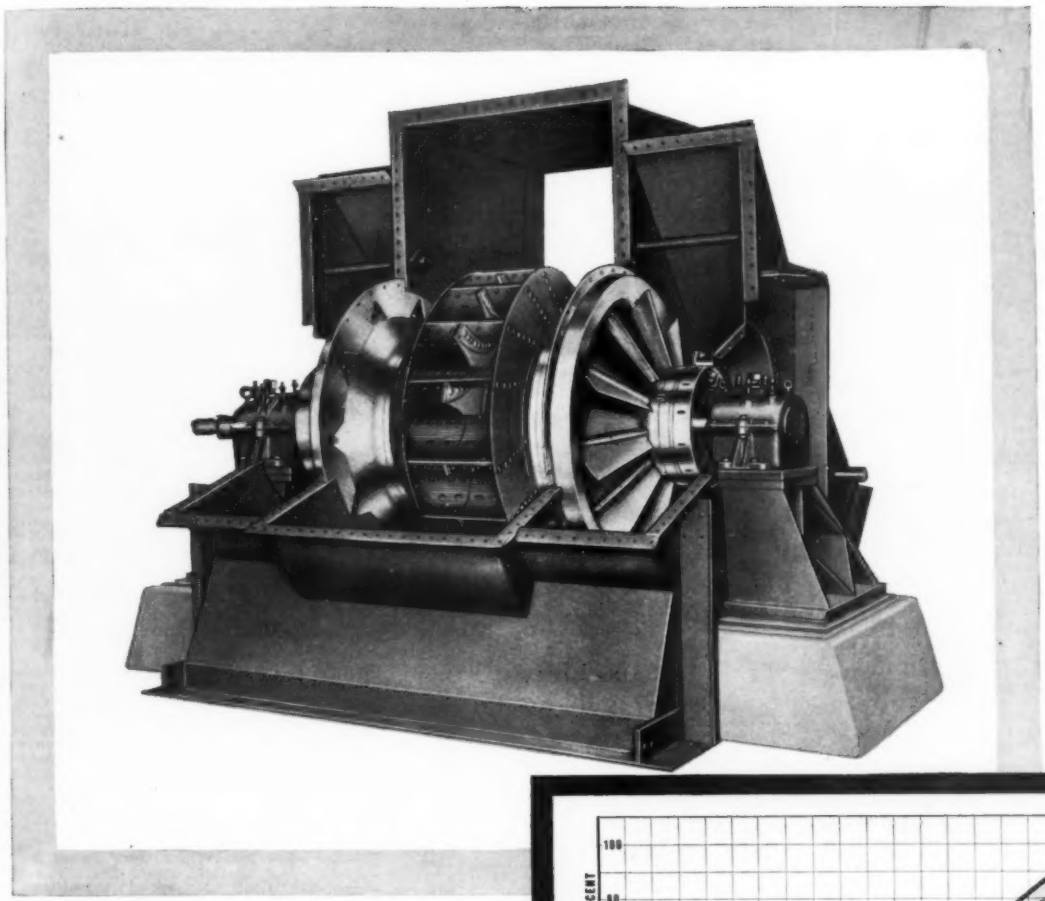
Full Fan Performance—Vanes are pivotted along conical elements to provide sufficient free area to achieve full fan performance when wide open. This conical arrangement of heavy cast or die-formed parts insures extreme rigidity to resist thrust loads.

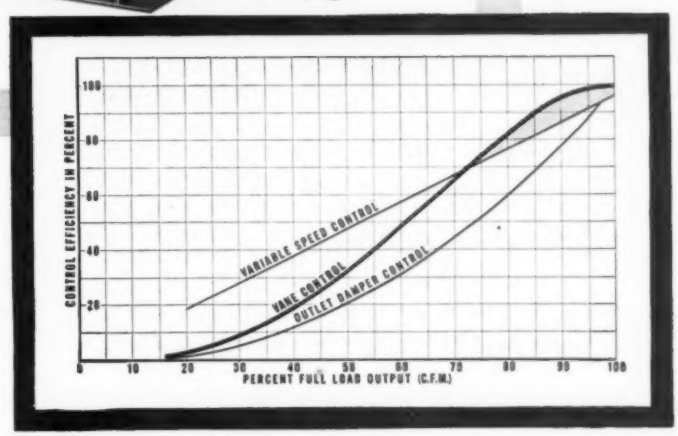
Link and Lever Action—The mechanism operates to give synchronized motion to vanes by link and lever action without the use of gears. Linkage from the operating shaft to the vane center is designed to effect a more rapid motion of vanes in the open range, and a slower motion in the near-closed position where finer adjustment is desired.

No Lubrication—No lubrication is necessary on any of the interior mechanisms of the control. Arrangement permits easy accessibility of all parts for inspection and maintenance.

For full information on Vane Control, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

Cutaway of a Sturtevant Induced Draft Fan, showing Vane Control shielded from the gas stream but open to access from the outside, and the Sturtevant E-R (Erosion Resisting) Wheel.





The comparison of control devices can best be shown by the relative "efficiencies" of the controls. Notice the "plus" region of Vane Control shown by the shaded area.

YOU CAN BE SURE...IF IT'S

Westinghouse

READERS' GUIDE ... CONTINUED ...

(Continued from page 27)

33—See page 148. Flat Glass Gages: Jerguson flat glass gages save money and labor—easy to install—available in wide range of sizes, pressures, designs and materials. Used for every liquid level indicating use. Write, outlining your problems and requirements. Jerguson Gage & Valve Company.

34—See page 138. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired unit. The Liquidometer Corp.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

35—See page 131. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

36—See page 17. Colloidal Graphite: Send for your copy of the New Acheson Bulletin No. 424 on the subject **"dag"** colloidal graphite for industrial lubrication. See how it will pay you to incorporate **"dag"** colloidal graphite into your present lubricants. Acheson Colloids Corp.

37—See page 141. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

38—See page 56. Lubrication Service: Whenever you have a lubrication problem—maintenance, repair or supply—call Alemite. Write today for the name and address of your nearest Alemite representative. More than 1,700 Alemite service and supply centers across the nation assure you quick, efficient service. Alemite Corporation.

39—See pages 35, 36. Turbine Oil; Greases: Nonpareil turbine oil eliminates oil acidity troubles and oil system maintenance once and for all. Nonpareil lasts as long as turbine. Stanolith greases provide good lubrication at both high and low temperatures and solve problems caused by heat, water, or low temperatures. Stanolith grease lets you avoid cost and trouble of stocking and using a variety of special greases. For information on both Nonpariel turbine oil and Stanolith greases write Standard Oil Company (Indiana).

MAINTENANCE

40—See page 111. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete information. Rust-Oleum Corporation.

41—See page 144. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 diagrams. Send today for your copy. Smooth-On Mfg. Co.

MATERIAL HANDLING

42—See page 138. Krane Kar: Gasoline powered. Works inside and outside your plant. Handles loads at front or sides. Don't wait to get more information. Ask for Bulletin No. 79 or for a Sales-Engineer. Silent Hoist & Crane Co.

43—See page 58. Bulk Materials Handling Systems: Long experience has given Stephens-Adamson Engineers the "know-how" that cracks bulk materials handling problems quickly and economically. Their staff is at your service. Write them today. Stephens-Adamson Mfg. Co.

44—See page 52. Skip Hoist: Gives you practical solution to the problems of conveying coal and coke to producer storage. The skip bucket keeps the producer-storage bin filled at all times. Write for information about G-W's free non-obligatory service of surveying your present method of moving materials. Gifford-Wood Co.

45—See page 135. Conveyoflo: Weighs coal in transit, gives positive control of pulverizers—ideal for operating rate-of-flow indicators at central control panel. Saves valuable floor space as it fits right into present conveyors, requires no overhead framework or external lever system. Write for full information and descriptive bulletins. Builders-Providence, Inc.

46—See page 4. Bulk-Flo Conveyors: The functions of conveyor, elevator and feeder can be combined in a single unit of high capacity, can handle coal from car to storage pit. Send for Book No. 2175. Link-Belt Co.

PACKINGS AND GASKETS

47—See page 124. Packings: Palmetto Twist gives greatest economy over a long period of service—each strand built for 600 F superheated steam; lubricant impregnated for friction-free, self-lubricating performance. Won't harden, won't bind valve stems or pump shafts. High tensile Canadian white asbestos. Full facts in Bulletin LP-10. Write today. Greene, Tweed & Co.

PIPE AND FITTINGS

48—See pages 50, 51. Gun-Pakt Expansion Joints: Send for free Bulletin EJ-1912 for the full story on Yarway Expansion Joints. Insert a plug of packing, turn a wrench, the joint's tight and all under full steam pressure. Write today. Yarnall-Waring Company.

49—See page 67. B & W Tubes: The B & W Tube Company representatives are pass keys to all tubing problems—pressure or mechanical—carbon, alloy, or stainless—special shapes—tailor-made physical and chemical properties. Trained in "tube-techniques". Experienced in uncovering unexpected tubing economies. Write for name of representative near you. The Babcock & Wilcox Tube Company.

50—See page 132. Universal Joints: Made of precision high grade alloy steel. Concentricity guaranteed within .0005. Fourteen sizes, solid or bored. Send for free literature for complete details. Lovejoy Flexible Coupling Co.

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51—See page 142. Pipe Fabricating Specialists: Meet your most exacting specification with absolute satisfaction on all pipe fabricating for oil, chemical, concrete, asphalt, and other industrial requirements. Fabricating Division, Albert Pipe Supply Co., Inc.

52—See page 44. Ball Bearing Swivel Joints: Available in over 500 types, styles, and sizes—in steel, malleable iron, bronze and aluminum. Write for latest catalog and engineering data. Chiksan Company.

53—See page 146. Flexible Metallic Hose: "Atlantic" metal hose survives most extreme conditions. Seamless or interlocking flexible metal hose in bronze, steel, stainless steel, monel. Standard or special couplings, flanges, nipples, fittings. Write for Catalog 100. Atlantic Metal Hose Co., Inc.

54—See page 21. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. The American Brass Company.

PLANT EQUIPMENT

55—See page 126. All-Service Hose: "Serv-all" is ideal for handling air, water, moderate amounts of gasoline and oil, mild chemicals, low-pressure insecticides. Solves inventory and cost problems of buying special hoses for infrequent use. Write for Bulletin 137 for complete data. Hewitt Rubber Division, Hewitt Robins Incorporated.

56—See page 143. Foreman's Steel Desk: This steel desk pays dividends in convenience and durability. Smooth, firm writing surface, easy gliding drawers, built-in locks. Steel desks take years of hard wear without losing trim appearance. Write for full details in Bulletin 728. Standard Pressed Steel Co.

POWER TRANSMISSION

57—See page 140. Worm Gear Speed Reducers: New vertical speed reducer designed specifically for agitators and mixers and for use with supplementary low-speed spur gear drives without outboard bearings. Write today for Bulletin 125. The Cleveland Worm & Gear Co.

58—See page 70. Whipcord Endless Belts: Manufactured to meet drive requirements of short centers, small pulley diameters, high speed and smooth operation. Write today for more information on this and other belting by Raybestos-Manhattan, Inc.

59—See page 49. Roller Chains: New "BA" assembly roller chain has all advantages of riveted roller chain plus even greater ease of field assembly and disassembly. Write for Bulletin 50-6 for all facts on "BA" assembly. Chain Belt Company, Baldwin-Duckworth Division.

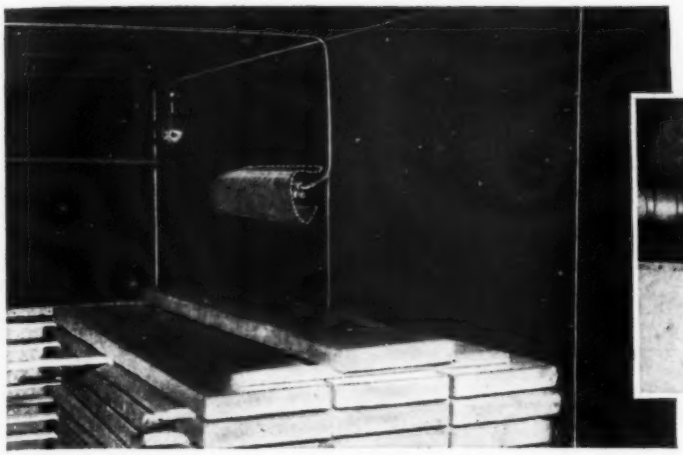
60—See page 43. V-Belt: Now, Gates has perfected a V-Belt Drive for looms. Write for information on Gates' V-Belt Drive for looms—how it cuts operating cost, gives bigger loom output with better quality of cloth. The Gates Rubber Company.

(Continued on page 32)

Is a penny a day too much

FOR PERFECT KILN, OVEN OR ROOM CONTROL

1¢



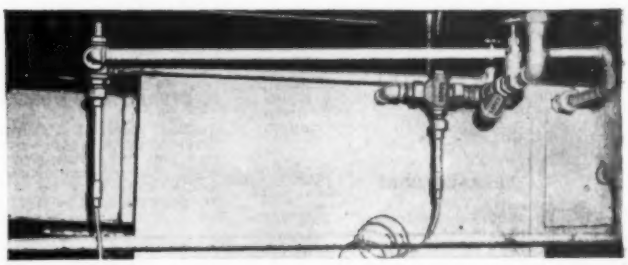
Mr. H. Klank, the maintenance engineer of the American Laundry Machine Company plant in Chicago says that this Sarco KR-14 Room Control has been on this wood kiln for 27 years without repairs. He ought to know, because he put it on there.

Recent reports include a Sarco Control in California overhauled after 24 years service and one in Cleveland in 25 years without repair and the owner figures that temperature control has cost him less than a cent a day.

OFFICE ROOM CONTROL

W. H. Barber, manufacturer of lubricating oils in Chicago, experienced difficulty with the office heating until the Sarco KR-14 room control with Sarco Float-Thermostatic Steam Traps were in stalled. Now "no trouble and don't expect any."

HEAT AND HUMIDITY CONTROLS



In baking, if it's not the heat—it's the humidity. This plant makes identical loaves of top quality bread day in and out because both heat and humidity of proof boxes are Sarco controlled.

LET THE SARCO ENGINEER NEAR YOU SUGGEST

274

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

READERS' GUIDE ... CONTINUED ...

(Continued from page 30)

61—See page 47. Chain Drives: Write for Catalog No. 508 for full information on Jeffrey Chains plus horse power ratings for various chain types and sizes, how to figure number of links of chain in a drive, depth of sag in slack side of chain drives and a variety of other helpful data. The Jeffrey Manufacturing Company.

62—See page 130. Bearing Bronze: Write for size chart A-1 with information on bar sizes manufactured with thinner than standard walls. These specials available for factory shipment in sizes above 4" O. D. and may permit you to reduce your present purchase weight or machine time. Each bar is free of blow-holes and burnt-in-sand. Magnolia Metal Company.

PUMPS

63—See page 66. "How To Get Longer Service From Your Pumps": That's the title of a booklet that belongs in the files of every man concerned with operating, maintaining, or purchasing pumping equipment. Be sure to write for your copy now. The International Nickel Co., Inc.

64—See page 127. Controllable Capacity Pumps: Endurance, low upkeep plus a saving in power. Send today for material giving full details and ratings of Aldrich-Groff "Power-Savr" Controllable Capacity Pumps. The Aldrich Pump Co.

65—See page 57. Complete Line of Pumps: Write for latest bulletin on centrifugal pumps or any other type of pump you may require. Worthington has one for every condition of service, all heads and capacities. Worthington Pump and Machinery Corporation.

66—See page 115. Unipumps: For efficient liquid handling in your plant—application, installation, replacement—consult a Weinman representative. Unipumps handle up to 1000 g.p.m., heads to 500 ft. The Weinman Pump Mfg. Co.

REFRACTORIES

67—See page 13. Refractories: Write for details on the B & W Refractories. Learn how they can cut operating costs in all types of industrial furnaces—large or small. The Babcock & Wilcox Co.

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68 — See page 146. Castable Refractory: Moldit Chrome saves installation time on floors and walls of boilers. Mixed with water, can be poured, troweled, shoveled or shot in place like concrete. No pounding or ramming needed. Gives exceptionally long life. Write for complete information. Refractory & Insulation Corp.

REGULATORS AND CONTROLS

69—See page 144. Thermostat and Diaphragm Regulating Valve: New Leslie thermostat features greatly increased throttling range, bi-metallic element, simple rugged construction. All work together for economic reliable control of cooling water. Write for Bulletin 464-B. It gives complete descriptions. Leslie Co.

70—See page 31. Heat and Humidity Controls: Sarco KR-14 Room Control gives you temperature control at low cost (less than 1c a day) over long years' service. Let Sarco engineer nearest you help you solve your temperature and humidity control problem. Write for full data. Sarco Company, Inc.

71—See page 125. Pressure Regulators: Masoneilan reducing valves cut waste, costs and save money by holding pressures within required limits without constant maintenance. No. 11 for steam service, has maximum working pressure 250 psi. No. 227 for water service, has maximum working pressure 150 psi. Write for full details. Mason-Neilan Regulator Company.

72—See page 41. Pressure and Temperature Control: Type ED Pressure Regulator insures accurate, dependable regulation year after year with less down-time, less time and money wasted on replacement parts. Spence Pressure and Temperature Regulators in sizes from ¼" to 12" for service with air, steam, water, oil or gas. Write for further information. Spence Engineering Company, Inc.

73—See page 128. Air Conditioning Control: Accurate control often means a better product at lower cost. Inquire today as to how Powers can give you better air conditioning control and valuable aid in selecting the right equipment for your requirements. Request full details on the many different types of Powers controls. The Powers Regulator Co.

74—See page 23. Combustion Safeguard: Fireye is the safe, modern electronic combustion safeguard for oil, gas, and pulverized coal burners. Provides continuous monitoring of oil or gas flame, programming control for automatic ignition systems, boiler water level control and low level safeguard. Write for Bulletin 604-C for complete details. Combustion Control Corp.

STEAM TURBINES AND ENGINES

75—See page 53. Terry Turbines: Any Terry district representative will gladly give you full information on a turbine to meet your requirements, no matter how special they may be. Or write directly. No obligation. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

76—See page 132. Chain Tongs: For pipe, fittings, and flanges. Write for catalog for complete showing and description of pipe tools. Armstrong Bros. Tool Co.

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77—See page 6. Pliers: Newly designed Proto pliers give even better service than ever before. Fine alloy steel, sturdy construction, good balance, correct leverage are just a few of the values. Write for catalog. Proto Tools. Plomb Tool Company.

78—See page 117. Tube Cleaning and Expanding: Write for sound advice and top service on your tube cleaning and tube expanding problems. Airetool products help you cut down time, give lower maintenance cost, more thorough scale removal. Airetool Manufacturing Company.

79—See page 136. Tube Expanders and Cleaners: Write for Bulletin 380 for complete details on Wilson-Dudgeon Tube Expanders. No matter what your tube expander problem, there's a Wilson-Dudgeon Expander that will fit your specific application. Catalog No. 76 outlines complete data on Wilson's tube cleaners — these cleaners quickly handle toughest deposits, clean both straight and curved ferrous and non-ferrous tubes. Thomas C. Wilson, Inc.

TRAPS, STRAINERS AND SEPARATORS

80—See page 151. Impulse Steam Traps: Discharge continuously under heavy loads, quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

81—See page 121. Steam Traps: Catalog No. 250 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

82—See page 2. Steam Trap Handbook: Tables, charts, diagrams and rules for selecting traps, giving complete explanations, make the new 36-page book a handy reference volume for every engineer's library. Send for Armstrong Steam Trap Book. Armstrong Machine Works.

VALVES

83—See page 130. Butterfly Valves: Write for Catalog describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 84". Pressures to 125 psi. W. S. Rockwell Company.

84—See page 3. Automatic Valves: Non-return stop and check valves, pressure reducing valves and back pressure valves available in sizes to keep your manifold heating service out of trouble. Other Foster valves for every type of service. Write for more details and help with your engineering problems. Foster Engineering Company.

85—See page 62. Check Valves: Chapman Tilting Disc Check Valves work with the steam so pipe line stresses are practically eliminated. Head losses are reduced 65% to 80%. Write today for engineering data and reports of tests. The Chapman Valve Mfg. Co.

86—See page 145. Plug Valves: These rubber-faced, metal-cored plugs seal air-tight every time—no friction, no lubrication. Write for new catalog on these easy operating plug valves. DeZurik Shower Co.

(Continued on page 33)

READERS' GUIDE

(Continued from page 32)

87—See page 68. Bronze Union Bonnet Gate Valves: Descriptive Circular No. 534 explains features of these valves such as self-adjusting double wedge discs, patented, wear-resistant stem, and perfectly machined repacking seats. The Lunkenheimer Co.

88—See page 65. Gate Valves: Folder AD-1803 tells you how Crane Fluid-Motor Operated Gate Valves can help increase operating efficiency of your plant. Low first cost, low operating cost, Crane Fluid-Motor Operated Valves save labor, prevent accidents and offer definite advantages when installed on hard-to-reach valves or valves used in timed operating cycles. Crane Co.

89—See page 9. Bronze Gate Valve: New "Swingtite" has exclusive rolling disc and guide track design for longer valve life, maximum tightness. Prevents uneven wear of seating surfaces. Swingtite can be opened or closed instantaneously and easily. Write for folder, Form No. 196 for full details. Jenkins Bros.

90—See page 145. Multiport Valves: Use electrically operated H & T Poppet Type Multiport Valves to make your zeolite water softeners or sand filters automatic. Write for Bulletin V-1. Hungerford & Terry, Inc.

WELDING EQUIPMENT

91—See page 64. Welding Rods: These welding rods consistently give welds of uniformly high quality—help weld better and faster at lower cost. Write for information. The Linde Air Products Company.

MISCELLANEOUS

92—See page 27. Automatic Printing Calculators: The only calculator that multiplies and subtracts, and prints every factor and answer on the tape for **immediate** proof of accuracy plus **permanent** proof for your records. Ask for free informative brochure "Command Performance". Remington Rand, Inc.

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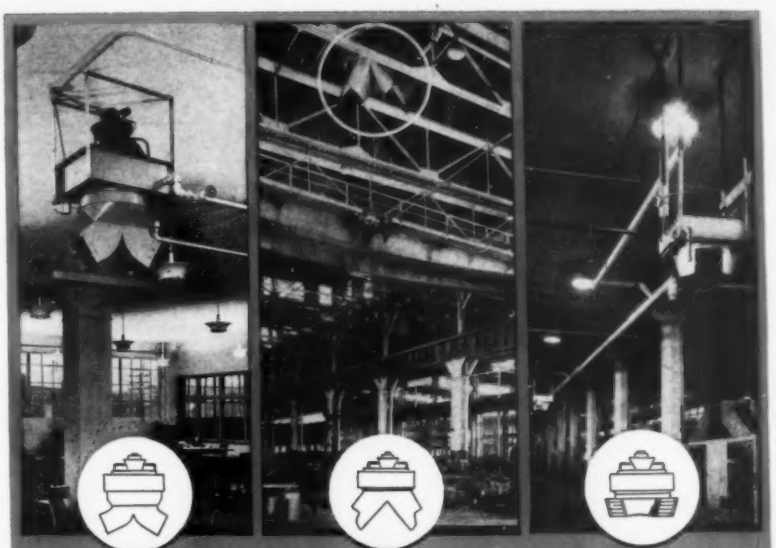
FOR SALE

PERFECT OPERATING CONDITION

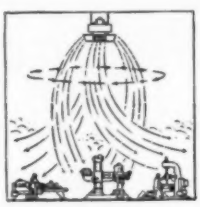
ONE 750 KVA and ONE 1000 KVA

G. E. TURBO-GENERATORS

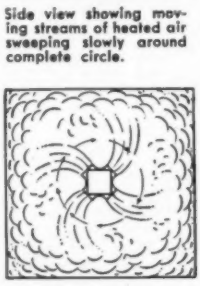
Thomas Bryan and Associates, Inc.
620 M & M Bldg.
Houston, Texas



The Discharge Outlets REVOLVE —only with WING unit heaters



Side view showing moving streams of heated air sweeping slowly around complete circle.



Top view showing coverage

The distinguishing feature of the WING Revolving Unit Heater, which makes its performance so outstandingly superior to other heaters is the Revolving Discharge Outlet. These outlets, moving slowly through a complete circle, flood the entire heating area with a blanket of fresh, live, warm air. The gentle air motion caused by the constantly changing directions of the heated air from the revolving outlets creates a refreshing, stimulating atmosphere beneficial to employee morale and productivity. Hot blasts and chilly areas are eliminated. Get complete information by writing today for Bulletin HR-5.

L. J. Wing Mfg. Co.

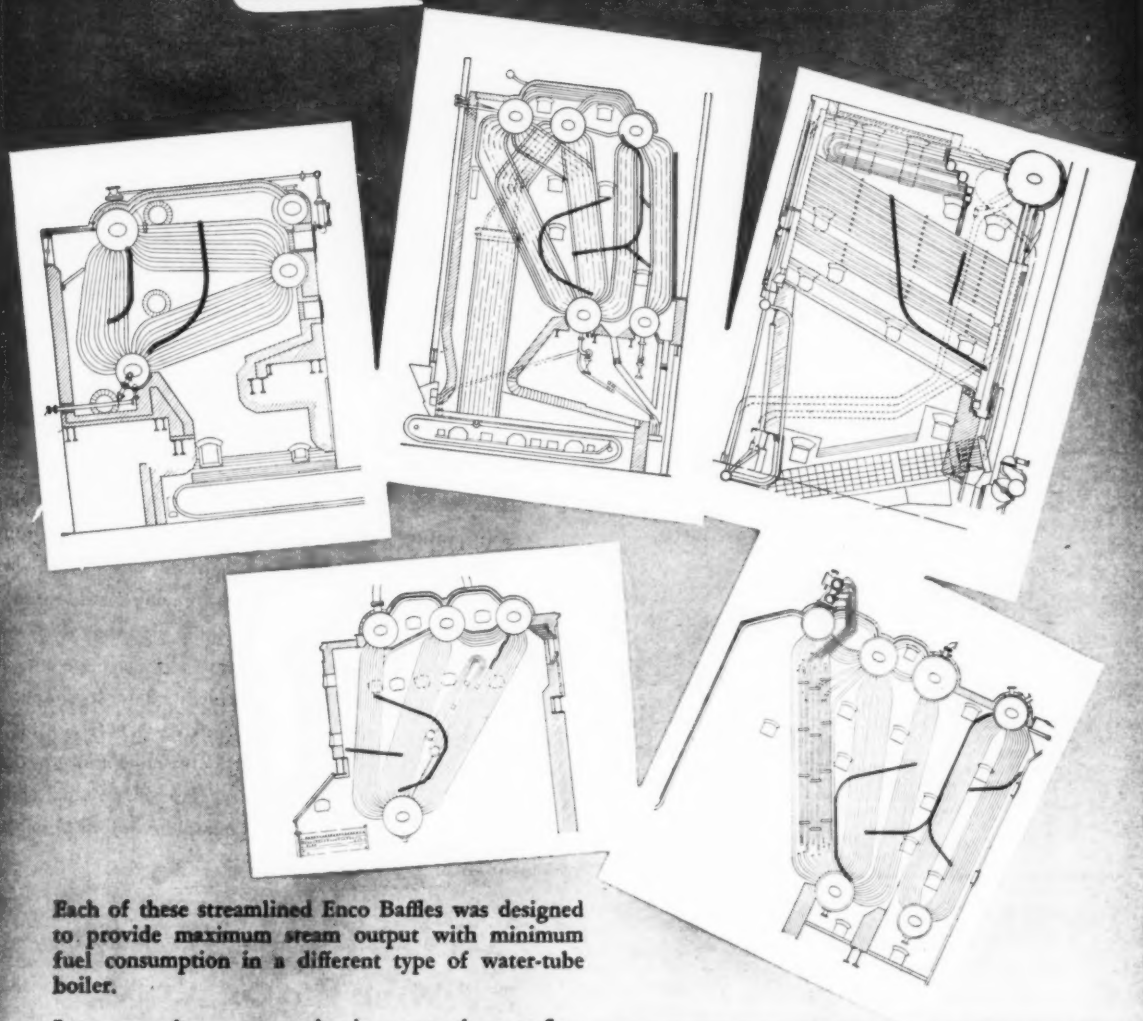
Executive Offices and Factory: 139 Vreeland Mills Road, LINDEN, N. J.
Canadian Factory: Montreal, Canada

Manufacturing Licensee for Wing Unit Heaters in Western Europe—ETABLISSEMENTS WANSON—9, rue Mogador, Paris 9e, France Nouveau Boulevard de la Woluwe, Haren-Nord, Brussels, Belgium.

Wing

Revolving
UNIT HEATERS

Streamlined for Savings
IN EVERY TYPE OF BOILER



Each of these streamlined Enco Baffles was designed to provide maximum steam output with minimum fuel consumption in a different type of water-tube boiler.

Long sweeping curves maintain a smooth cross flow of gases across every square foot of heating surface. Eddy currents, bottlenecks and dead gas pockets are eliminated—draft losses are cut to a minimum. Soot blowers work more effectively, less steam and less time are needed for cleaning.

Enco Streamline Baffles are individually designed and engineered to the exact requirements of your boiler. Experienced Enco-trained crews take charge of the installation.

The 18-page Enco Bulletin, BW44, shows how engineers throughout industry have gotten higher boiler efficiency and increased steam production through the use of Enco Streamline Baffles. Why not write for your FREE copy today?

The Engineer Company Produces:

ENCO OIL BURNERS

ENCO FUEL OIL PUMPING AND HEATING UNITS

ENCO AUTOMATIC OIL-ELECTRIC IGNITION SYSTEM

ENCO AUTOMATIC COMBUSTION CONTROL

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75 WEST STREET, NEW YORK 6, N. Y.

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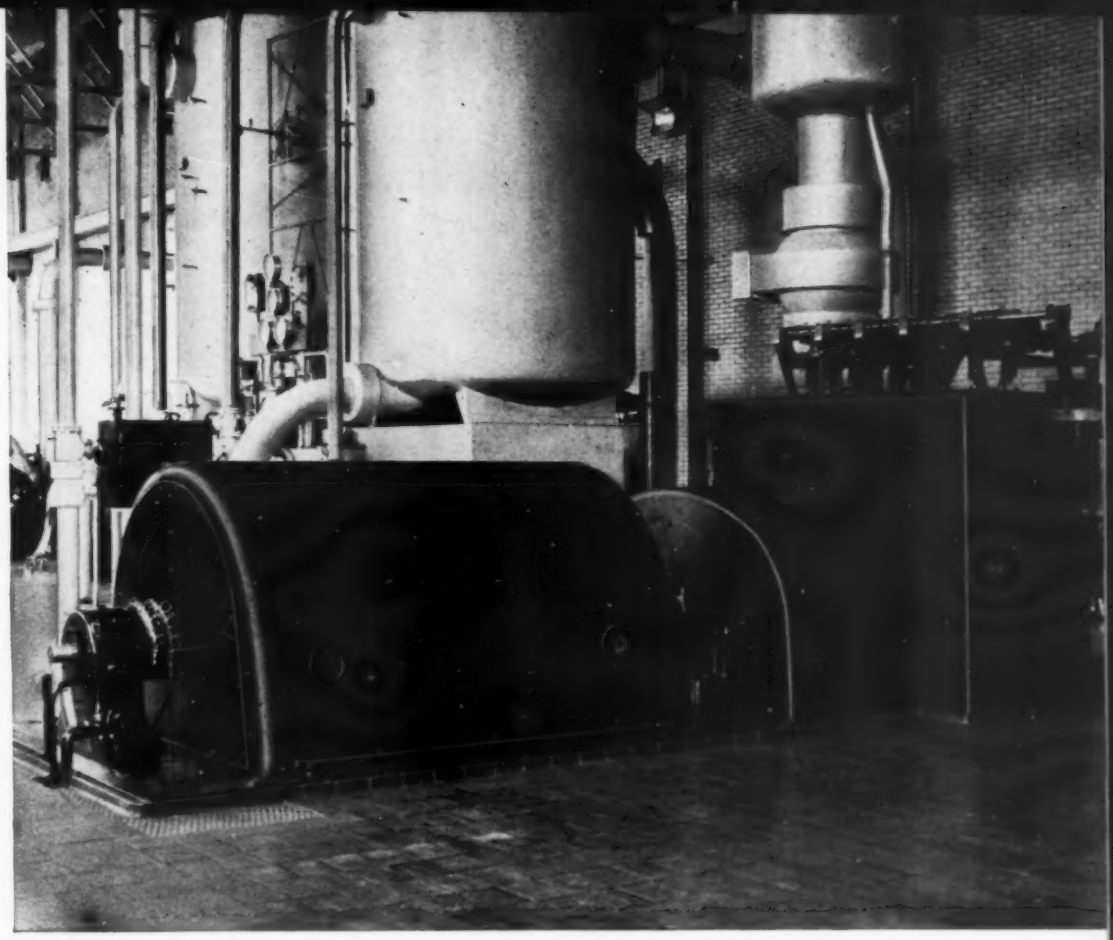
F. J. Raskin, Ltd., 370 Rachel E., Montreal, P. Q.

EC-673



Used 18 years, oil goes right back on the job

● In 18 years of operation, the original fill of NONPAREIL Turbine Oil was never removed from this 2500-KW turbine at the University of Michigan power house. Neutralization numbers always stayed below 0.07 mg. KOH/gm. Tests of oil samples showed no deterioration of the lubricant.

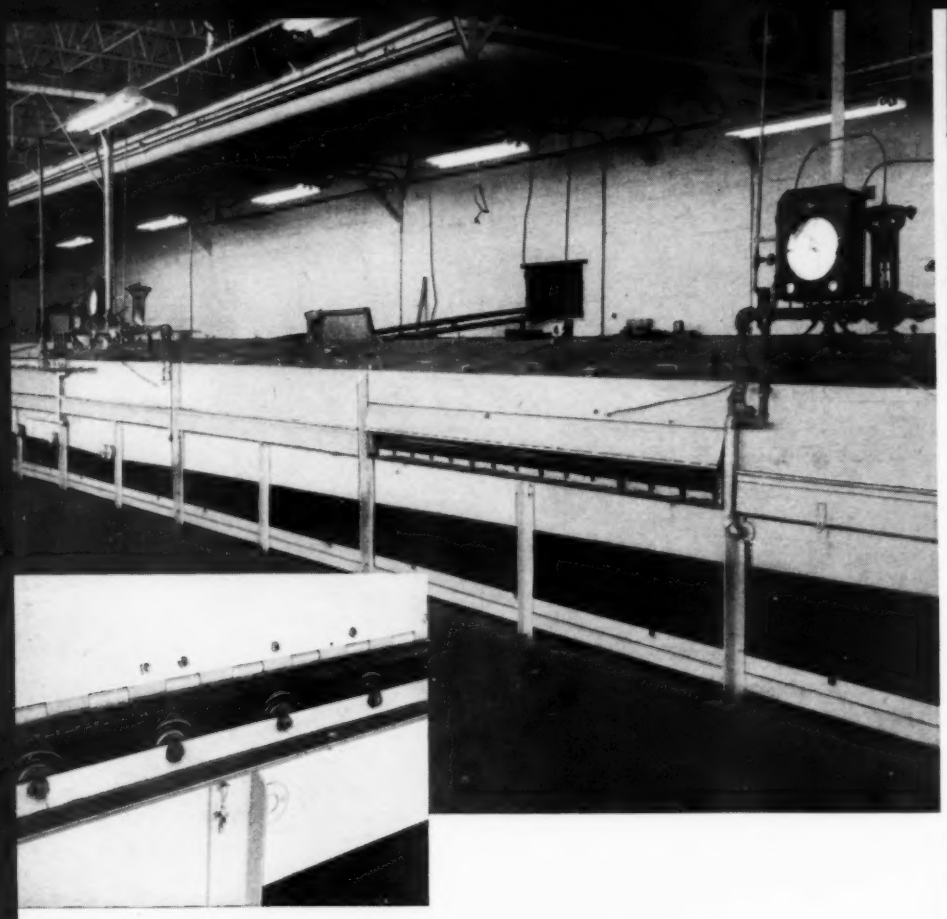
Recently, the turbine was shut down for inspection and general overhaul. Operators drained NONPAREIL from the unit and took a close look at the oil system. *They found no oil deposits, no evidence of rust, and not a sign of corrosion.* The oil itself was in excellent condition and after centrifuging it was returned to the turbine for continued use.

You, too, can obtain such lubrication advantages. By switching to NONPAREIL Turbine Oil, you can eliminate oil acidity troubles and oil system maintenance once and for all. These benefits are not only indicated by the experience of others but are backed by the written guarantee you receive that NONPAREIL will last as long as the turbine and that its acidity will stay below 0.15 mg. KOH/gm.

A Standard Oil lubrication specialist will be glad to supply you with actual case histories of utility operations on which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. To arrange for his visit, write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

NONPAREIL
Turbine Oil

STANDARD OIL COMPANY (INDIANA) STANDARD



Bearings lubricated not once a day but once in two weeks

CONVEYOR ROLLS on the pasteurizer (above) are continually subjected to water spray at temperatures ranging from 60°F. to 212°F. Under such conditions it is usually extremely difficult to lubricate the roll bearings.

When this unit was installed, it was expected that rolls would have to be lubricated daily—a large order on a conveyor 80 feet long with rolls spaced 6 inches apart. However, a Standard Oil lubrication specialist was asked for his recommendation. He selected STANOLITH Grease—a lithium-soap product with the ability to withstand both heat and water.

The conveyor, now operating on STANOLITH, is lubricated—not daily—but *once every two weeks*. STANOLITH provides good lubrication at both high and low temperatures in the machine and is not washed away by the spray.

Lubrication problems caused by heat, water, or low temperatures in your plant can be solved by this one lubricant: STANOLITH Grease. Through its remarkable versatility, you can avoid the cost and trouble of stocking and using a variety of special greases. A Standard Oil Lubrication Engineer will help you make these savings. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANOLITH
TRADE MARK
Greases

What's YOUR problem?

Mr. J. D. Clark of Standard Oil's Saginaw, Michigan, office is the lubrication specialist who helped this customer make a worthwhile saving by recommending STANOLITH Grease.

Standard's lubrication specialists are located throughout the Midwest. One of them is within easy reach of your plant. He offers you an on-the-spot lubrication service that's backed by extensive experience and training in the use of modern lubricants and fuels. He can help you make important reductions in operating and maintenance costs.

Arrange, today, for a visit of this lubrication specialist by phoning or writing the nearest Standard Oil Company (Indiana) office. Ask him to give you actual performance data on these outstanding products:

STANOIL Industrial Oils—This multi-purpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types, SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

CALUMET Viscous Lubricants—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better internal lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUSTS form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD **STANDARD OIL COMPANY (INDIANA**

FOR COMPLETE INFORMATION on NEW EQUIPMENT and DEVELOPMENTS

as well as the latest

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TEAR OUT A CARD

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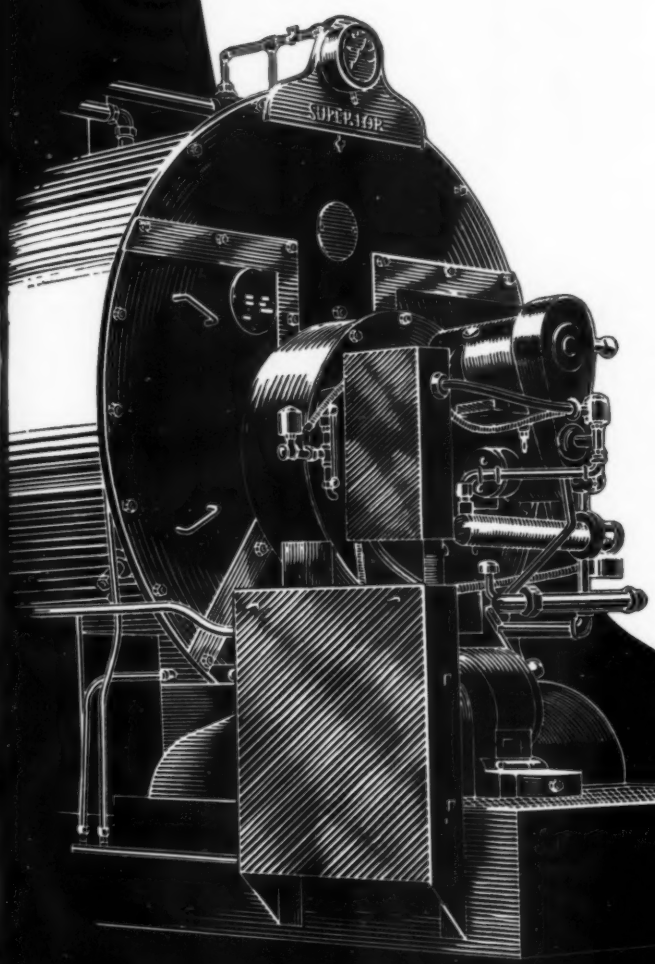
For STEAM DIVIDENDS Tomorrow

Buy SUPERIOR STEAM GENERATORS Today



The operating economies which result from Superior's higher efficiency and long-lived dependability pay *real* dividends to their owners. Their thermal efficiency (guaranteed to exceed 80%) insures lowest fuel costs. Their rugged, heavy-duty construction spells years of dependable, trouble-free operation.

Fuel and maintenance savings are outstanding where Superior Steam Generators have replaced older equipment . . . but the greatest dividends result where Superior Steam Generators are specified for new steam plants. For here are added to their economy of operation (1) the economy of small space, (2) the elimination of an expensive stack (for Superior's induced draft requires only a vent for the products of combustion), and (3) simplified installation resulting from Superior's complete factory assembly and wiring.

There'll never be a better time to buy a Superior Steam Generator . . . because these dividends start with the first day's operation, and every day thereafter adds its dividend.

17 sizes from 20 to 500 b.h.p. for pressures up to 250 p.s.i. Fully automatic with all grades of oil or gas. For complete data write for Catalog 202.

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Factory Emmaus, Pa.
Executive Offices Times Tower, Times Square, New York 18, N. Y.

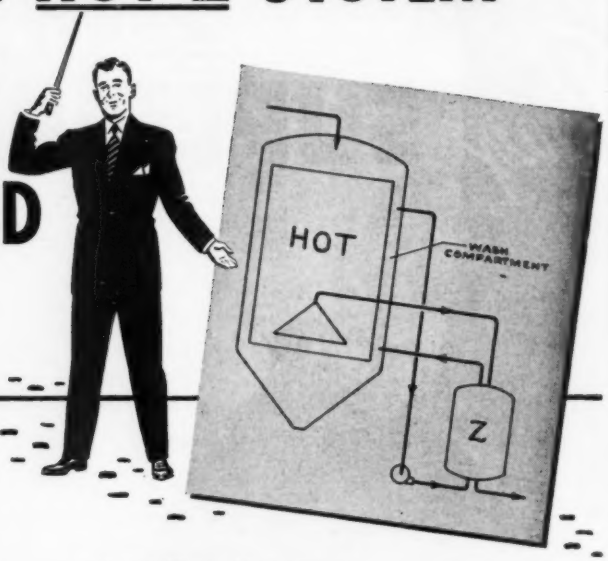
REVOLUTIONARY

advance in boiler feed water treatment!

WORTHINGTON HOT-Z SYSTEM

combines all the best features of

HOT PROCESS AND ZEOLITE



Choosing between Hot Process and Zeolite is no longer a boiler feed water problem. The Worthington Hot-Z System gives you the advantages of each system including deaeration.

SEE WHAT HOT-Z DOES FOR YOU:

1. Reduces hardness to 0.2 ppm without addition of excess soda alkalinity.
2. Operates on cheapest chemicals — lime and salt.
3. Saves enough in chemical costs to pay for average installation in 3 years.
4. Offers easy control when operating on variable waters.
5. Removes oxygen to 0.005 cc per litre.
6. Makes cumbersome two-tank lime-soda-phosphate systems obsolete.
7. Includes ideal facilities for the necessary hot clear water zeolite washing process.
8. Makes filters unnecessary except in special cases.
9. Does away with vent condenser scale.
10. Reduces phosphate precipitates in boiler to unobjectionable amount.
11. Reduces silica.

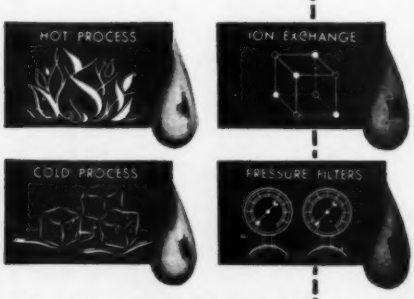
INVESTIGATE! If you are now considering split treatment, hold up your decision until you examine the Worthington Hot-Z System. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find in our Hot-Z System, as in so much other equipment, *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Dunellen, N. J.*

J0-2

WORTHINGTON

WATER CONDITIONING

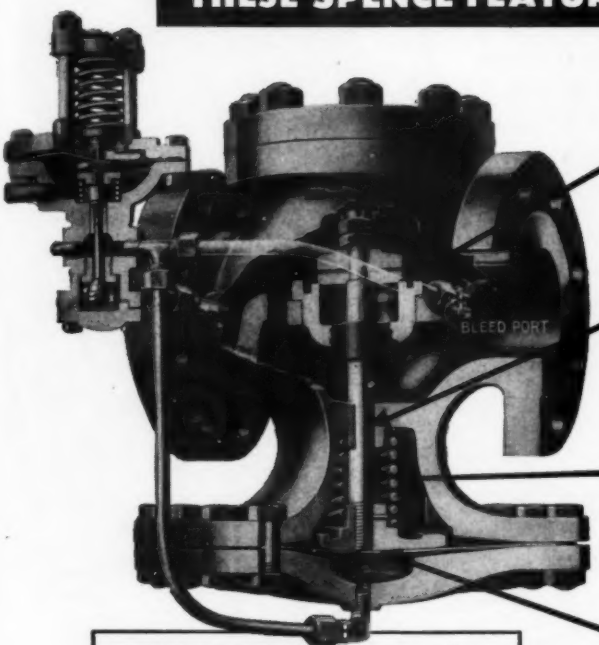
Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

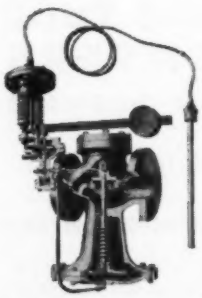
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

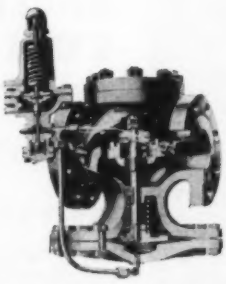
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

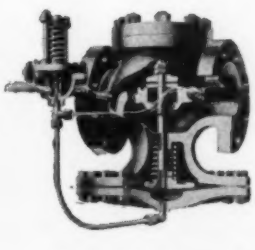
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corperation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

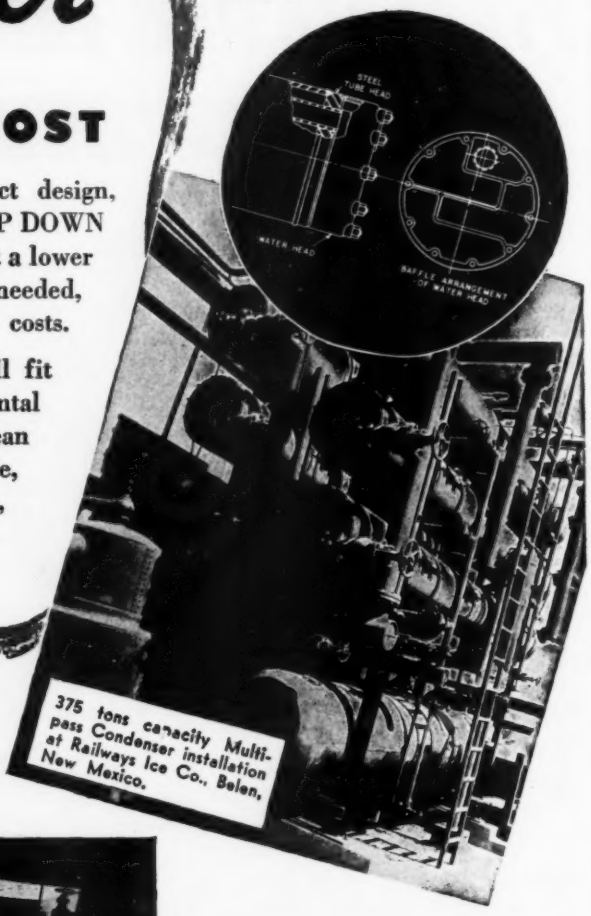
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

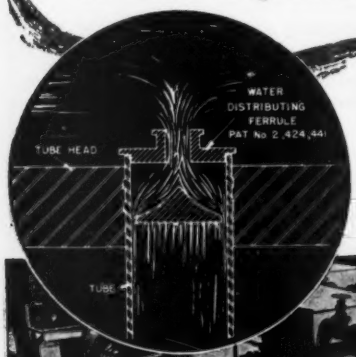
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

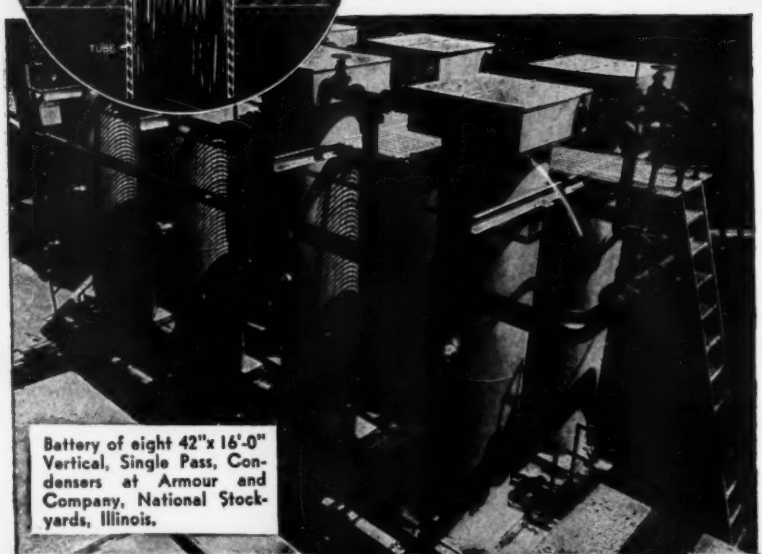


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

Gates
REG. U. S. PAT. OFF.

Achieves the long-sought V-BELT DRIVE for LOOMS

For Cotton Mills and Rayon Mills

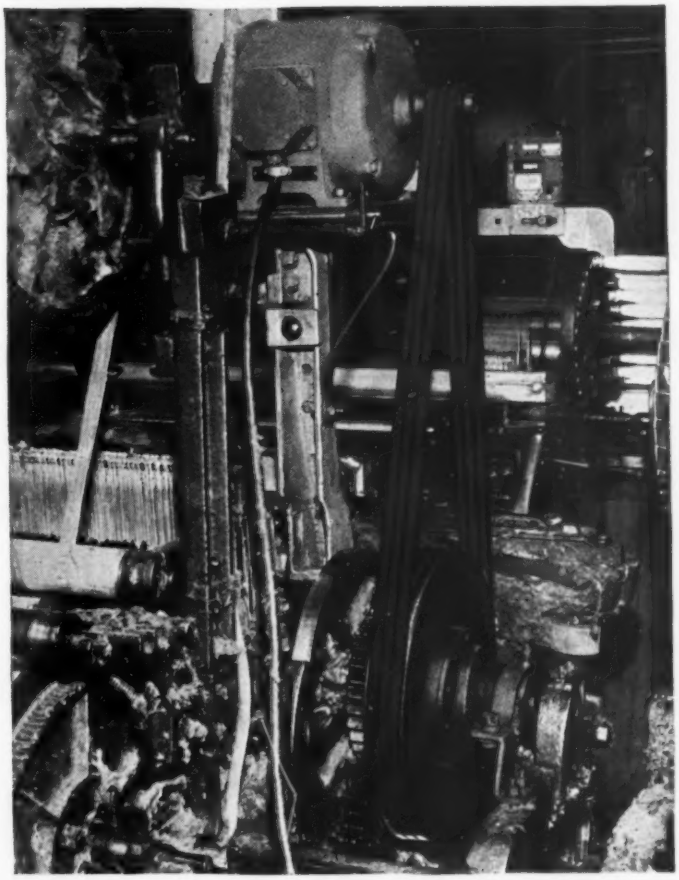
Loom operators had long *wanted* a V-Belt Drive for their looms. *But*—

Stubborn Difficulties

—stood in the way. Gates over-came these difficulties through *SPECIALIZED* research in the world's largest V-Belt testing laboratories, thus providing—

Another Accomplishment For Industry

by Gates *SPECIALIZED* Research



THE extremely small diameter of pulleys over which loom drive V-Belts must flex under severe shock-loads posed a problem in V-Belt construction that seemed *insurmountable.*

But, with war-born synthetic fibers of unusual strength; and with man-made rubbers possessing engineering properties never available before—and with the great research and testing facilities available at Gates—a V-Belt was achieved that met the rigorous conditions of loom drive operation.

Then, a clutch of very advanced design was wanted—a clutch that would do *more,* with *less* maintenance, and *fewer* troublesome adjustments than the clutches commonly used with gear and pinion drives on looms.

Gates therefore engineered a clutch that is a marked improvement over the clutches previously available for looms.

Finally—and this was most important, too—the entire drive assembly had to be so designed that it would go on the loom without any costly re-arrangement of existing mill equipment. This rather demanding job of design was also accomplished.

Today, the Gates V-Belt Drive for looms is cutting operating costs—and giving bigger loom output with better quality of cloth—in Cotton Mills and Rayon Mills the country over—another accomplishment of Gates *SPECIALIZED* Research!

ENG-505

THE GATES RUBBER COMPANY
The World's Largest Makers of V-Belts
DENVER, U.S.A.

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

WHEREVER YOU TURN.. there are CHIKSAN designs for your Flexible Lines

CHIKSAN *Ball-Bearing* Swivel Joints are manufactured in more than 500 different Types, Styles and Sizes, from ⅜" to 12" (larger sizes to order); for pressures from vacuum to 15,000 psi.; for temperatures from -40° to 700° F.; in malleable iron, nickel-bronze, aluminum, steel; for full 360° rotation in 1, 2, and 3 planes.

With CHIKSAN *Ball-Bearing* Swivel Joints, you can design lines with any required degree of flexibility merely by arranging swivels in proper sequence. CHIKSAN Engineers will gladly assist you with recommendations based on over a quarter-century of experience in design, manufacture and application. It is more than likely that a *standard* CHIKSAN Swivel Joint will fit your *special* requirements. That means saving you time in designing and in getting into production... and the money it costs for trials, experiments, special tooling and expensive manufacturing. Play safe! specify CHIKSAN *Ball-Bearing* Swivel Joints.

WRITE FOR CATALOG NO. 50

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
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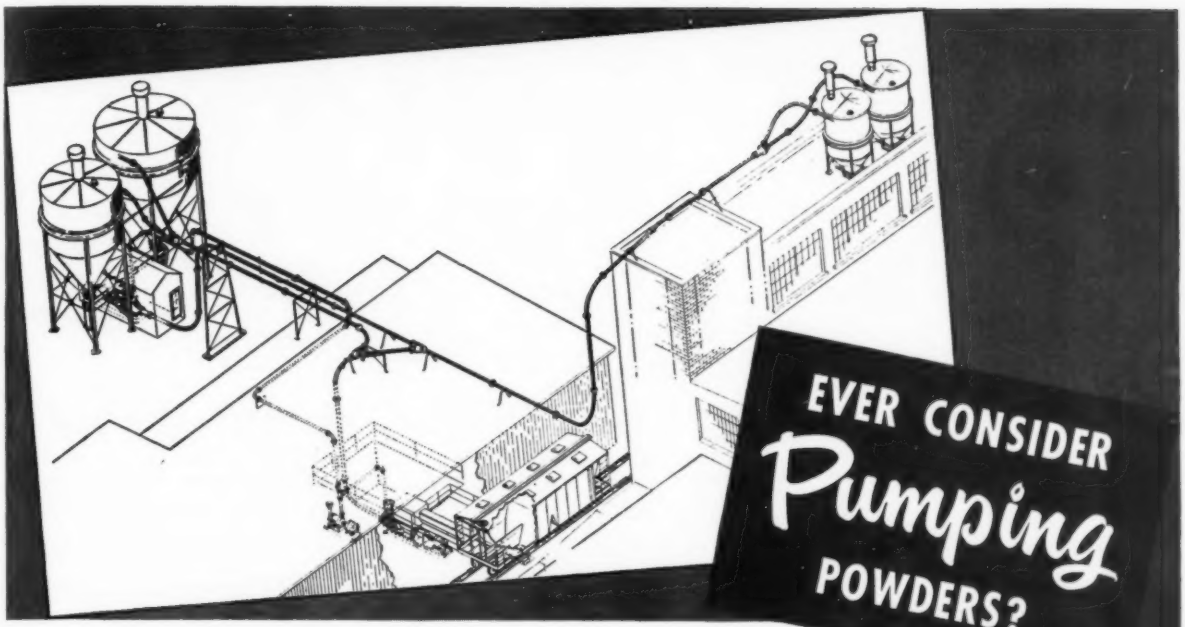
WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

REPRESENTATIVES IN PRINCIPAL CITIES...

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES



EVER CONSIDER
Pumping
POWDERS?

You Can With the FULLER-KINYON System!

Pulverized dry materials . . . like starch, cement, lime, powdered coal, fly ash or the like . . . have a unique characteristic. When they're aerated, they act like a liquid. Under pressure, they literally *flow* from one location to another . . . can be piped and distributed at will to bins in any part of a plant.

Think what this means to you. There's no dust nuisance or waste. Power consumption is at the minimum. Maintenance is low and supervisory charges can practically be wiped off the books.

Fuller-Kinyon Conveyor Systems can be installed and dry pulverized materials conveyed wherever a pipe-line can be run. What's more, one or more Fuller-Kinyon Pump Systems can be interlocked and operated automatically to distribute materials to any desired number of bins in sequence . . . but subject to instant remote control.

If costs for conveying starch, lime, cement, or similar pulverized dry materials have been cutting into your profits . . . if maintenance costs are climbing . . . you'll find it profitable and practical to call in Fuller. Chances are we can show you how minimum expenditure on your part can bring you a conveyor system that means maximum operating efficiency and a consequent improvement in profits.

FULLER COMPANY, Catasauqua Pa. • 120 S. LaSalle St., Chicago 3 • 420 Chancery Bldg., San Francisco 4

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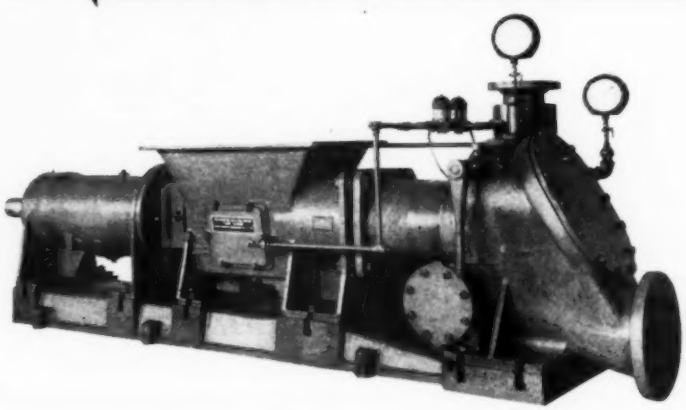
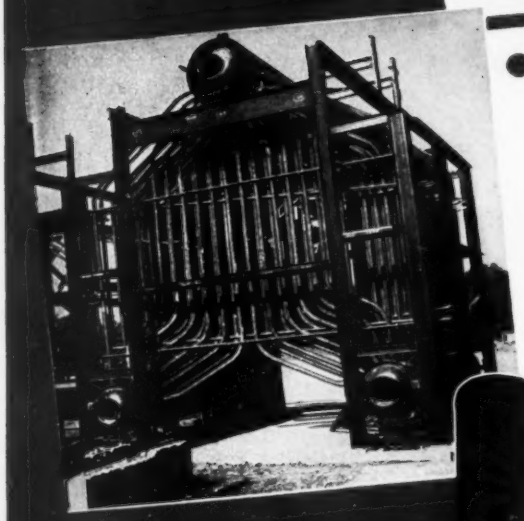
DRY MATERIAL CONVEYING SYSTEMS
AND COOLERS—COMPRESSORS
AND ASSOCIATED EQUIPMENT



P-114

UNION
"H" TYPE
STEAM GENERATOR



•The Ideal Outdoor Unit . . .

THESE photos tell their own story of the adaptability of the Union "H" Type Steam Generator . . . the Ideal Outdoor Installation.

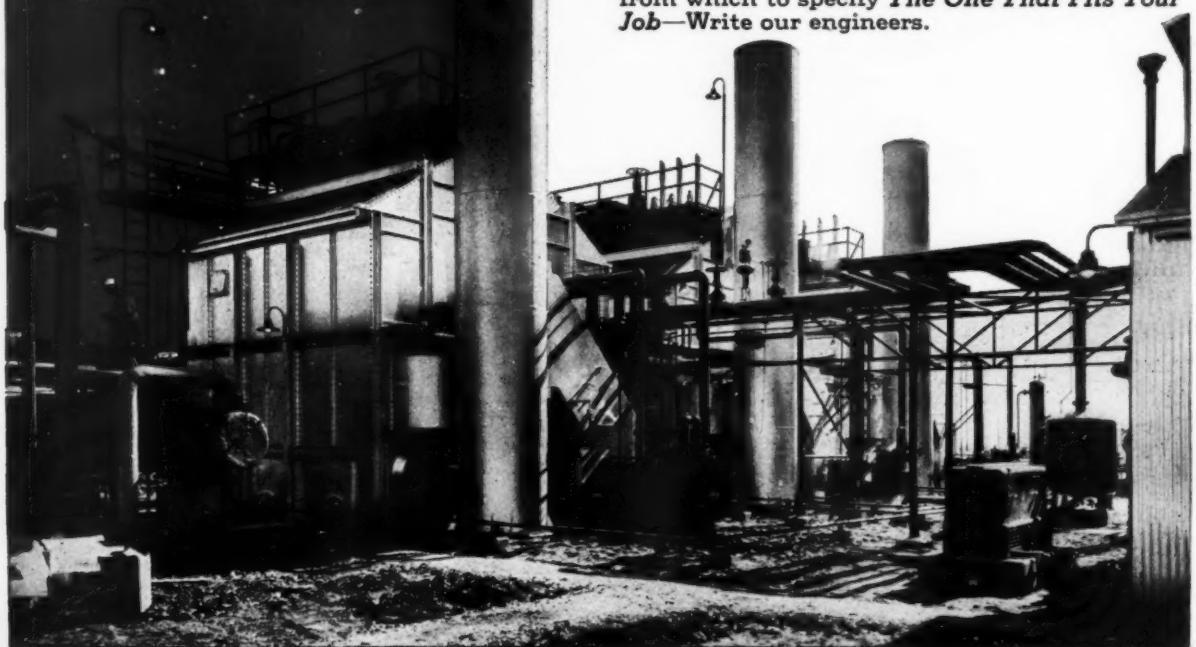
❶ Compact, simplified design in a steel clad insulated setting with furnace inside the unit.

❷ Drum and tube arrangement symmetrical . . . a tube bank on each side forming an integral water cooled furnace. No headers . . . No handhole plates required.

❸ Superheater on one side only provides (patented) simplified superheat control over a wide load range for all fuels and varying excess air. Automatic adjustment of boiler outlet dampers controls gas flow across superheater.

❹ Design accommodates any fuel or firing method for any desired capacity or pressure.

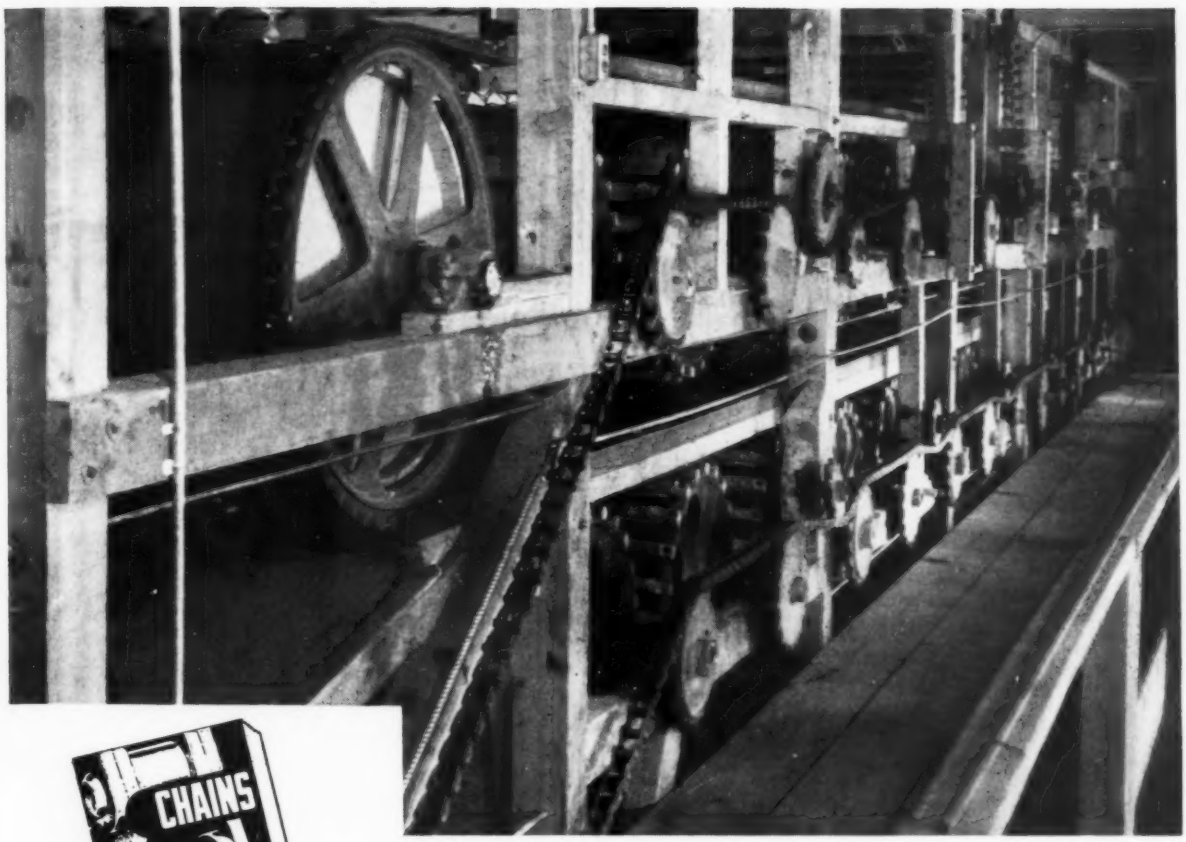
There are 13 basic Union boiler designs from which to specify *The One That Fits Your Job*—Write our engineers.

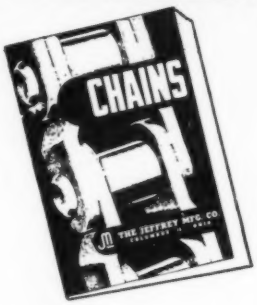


UNION IRON WORKS . . . *Since 1890*

703 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL





This JEFFREY Chain Catalog contains a wealth of chain data. In addition to an index of chains available, you will find Horse Power ratings for various chain types and sizes, how to figure number of links of chain in a drive, depth of sag in slack side of chain drive, tension in slack side of drive plus handy formulae and working loads as well as numerous other tables and dimensions. Write for this handy chain guide—Jeffrey Catalog No. 808—on your company letterhead. Do it TODAY.

JEFFREY *engineers chain for dependable drives*

● For example note the chain drive illustrated on this hop-picking machine. This is only one of hundreds of installations where Jeffrey Chain is handling the drive on vital production equipment in Industrial, Chemical and Food Plants . . . Mining and Construction operations of all types under all conditions.

If you are responsible for the design and development of equipment that requires dependable chain drives, it will pay you to investigate the Jeffrey line of chain. Jeffrey experience in building chain dates back more than 65 years and our engineers are available to work with you in determining the correct chain for your drive problem. Our new and improved Chain Department can take care of your requirements—*immediately.*

THE **JEFFREY**

MANUFACTURING COMPANY Established 1877

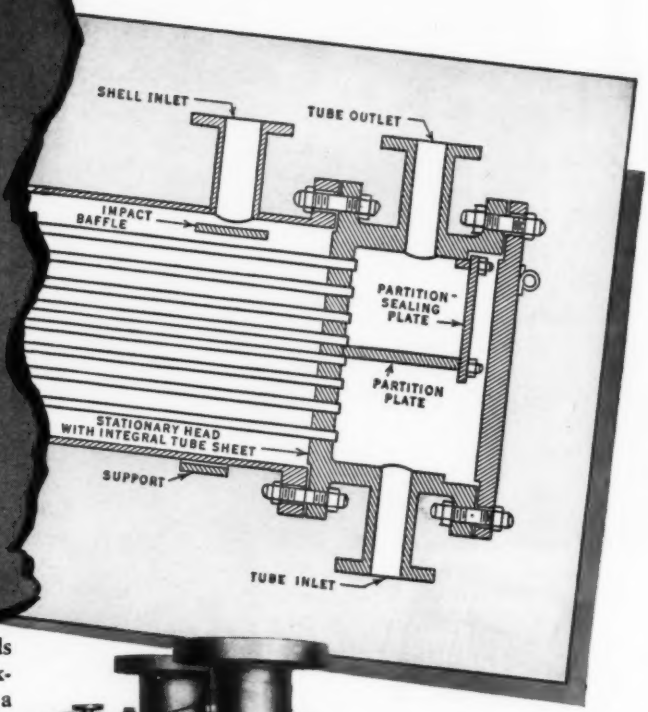
814 North Fourth St., Columbus 16, Ohio

Baltimore 2	Chicago 1	Detroit 13	Jacksonville 2	Pittsburgh 22
Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
Boston 16	Cleveland 13	Houston 2	New York 7	Salt Lake City 1
Buffalo 2	Denver 2	Huntington 19	Philadelphia 3	Scranton 3

Jeffrey Mfg. Co., Ltd., Head Office & Works: Montreal

Complete Line of Material Handling, Processing and Mining Equipment

Leakage Between Passes Prevented in G-R FEEDWATER HEATER



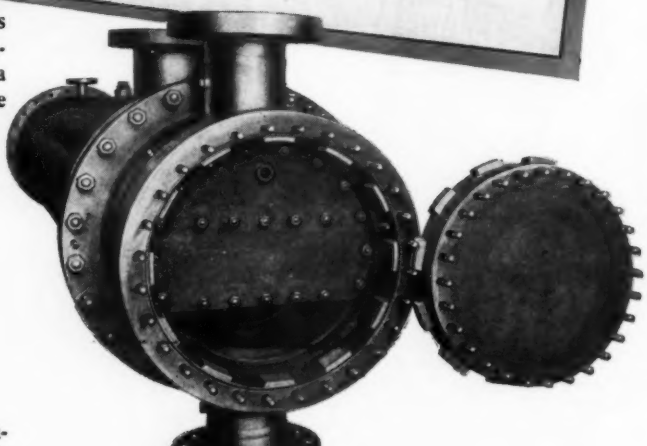
The partitions between passes in the water heads of feedwater heaters are a fruitful source of leakage that can't be detected. The head cover is a literal "iron curtain" behind which you can't see short-circuiting of water between passes.

●

Griscom-Russell offers designs of feedwater heater stationary and floating heads in which this inter-pass leakage CAN'T occur. How? By making the differential in water pressure between the passes help to keep the partition joints *tight* instead of tending to force them apart.

●

The sketches tell the story. It's one of many instances of G-R pioneering in the design of feedwater heaters. Write for bulletin describing these heaters and their many distinctive features that give you benefits you can't obtain in other feedwater heater designs.



THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

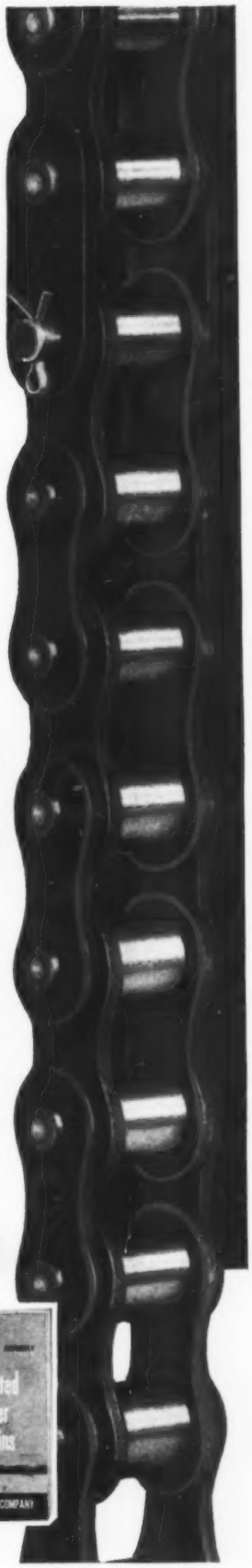
GR-501

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

WHERE YOU SEE *this* ... YOU SEE

Longer Chain Life, Lower Chain Cost, Easy Adjustment, Faster Service!

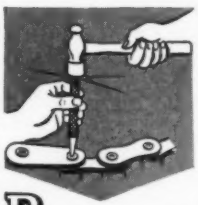


This distinctive link marks the new "BA" . . . Baldwin Assembly . . . riveted roller chain. And it's the mark of long, low-cost service.

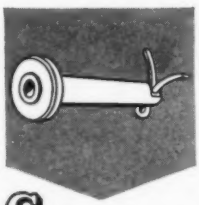
The new "BA" assembly roller chain gives you all the advantages of riveted roller chain . . . longer life . . . even greater ease of field assembly and disassembly than with old style detachable roller chains . . . and in single strand, lower cost.

HERE'S HOW SIMPLE IT IS TO TAKE APART *THIS* ROLLER CHAIN!

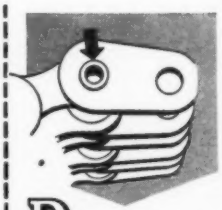
A The single pin connector is the heart of the "BA" assembly and is readily identified by its distinctive shape. One pin in this link has a cotter on one end; the other end is spun over a washer. The other pin is fully riveted to the adjacent link, thus assuring the assembly of the superior life of riveted chain.



B To take the chain apart, simply remove the cotter on the single pin connector link and drive out the pin. Pin is a slip fit through the chain except for a milled flat on the cottered end which is fitted into a special hole in the connector plate. There is no danger of destroying fits or damaging parts with this chain.



C The single pin connector of the "BA" assembly fits snugly into place . . . even though it is a slip fit through virtually the entire link. The washer spun over one end of the pin and the milled flat on the cottered end that is fitted into the special hole in the connector plate, plus the cotter, hold the pin firmly in place.



D An important advantage to you is the fact that the other end of the single pin connector link is firmly riveted to the adjacent link. When the single pin connector is removed, this riveted pin holds the chain parts together, thus keeping plates in line and preventing them from falling out, simplifying assembly.

For all the facts on "BA" assembly, write Chain Belt Company, Baldwin-Duckworth Division, 388 Plainfield St. Springfield 2, Mass., and ask for Bulletin 50-6.

BALDWIN·REX
ROLLER CHAINS

a complete line from ¼-inch to 2½-inch pitch

GUN-PAKT EXPANSION JOINTS

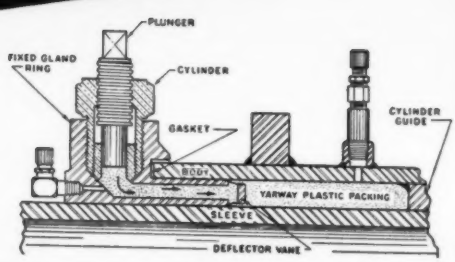
COST LESS

to maintain

require

NO SHUTDOWNS

for servicing



Close-up of cross-section showing detail of Gun-Pakt feature.

YARWAY

Maintenance costs are less because there's less maintenance.

In a nutshell, that's why more and more utilities, institutions and industrial plants distributing steam are turning to Yarway Gun-Pakt Expansion Joints.

Servicing Gun-Pakt Joints never interrupts heating or production. They are serviced under full steam pressure, without shutdowns.

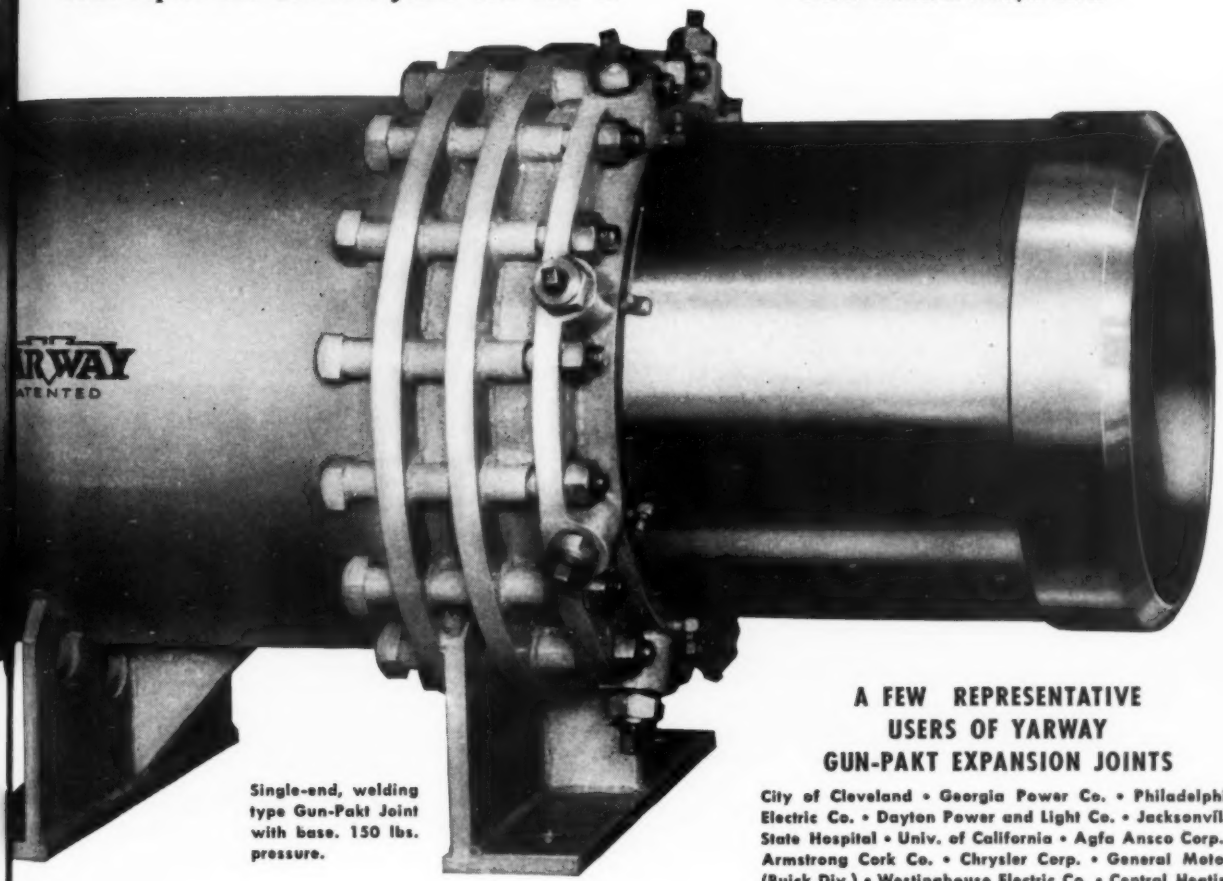
To repack a Gun-Pakt Joint you simply insert a plug of plastic packing, turn a wrench, and the job's done. Special Alemite fittings provide for proper lubrication.

Users report that Gun-Pakt Joints cost little to maintain. One who has kept accurate records says "65 cents per year per joint." Others claim even less.

Available with single or double ends, welding or flanged types, in sizes from 2" to 30", with traverses from 4" to 24", and for pressures to 400 psi.

For the full Gun-Pakt story, as well as information on other Yarway slip-type joints, write for Yarway Bulletin EJ-1912.

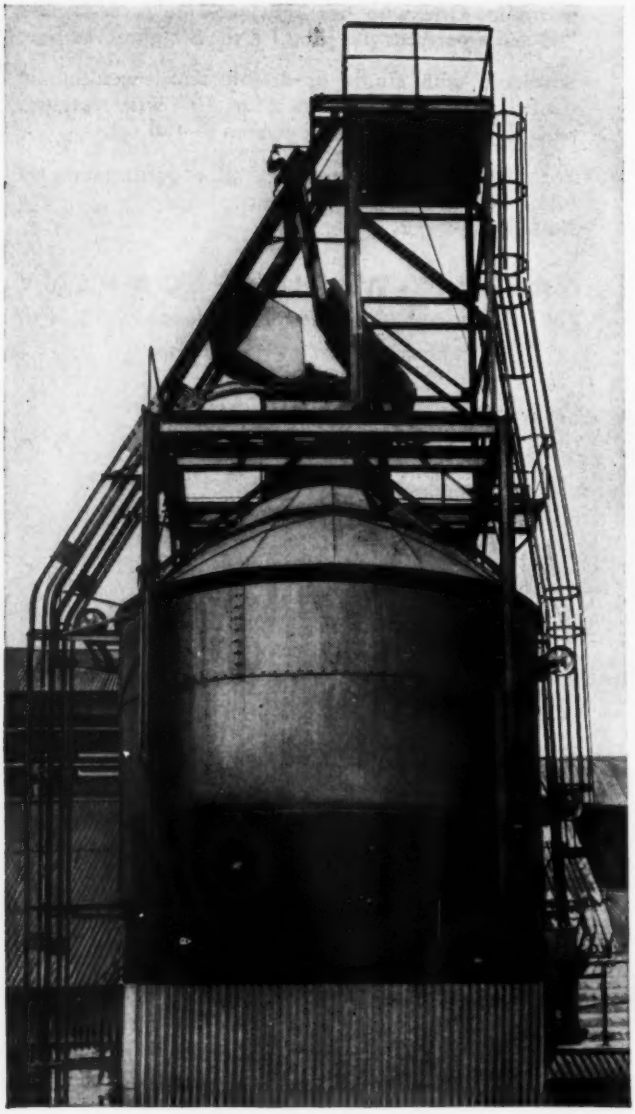
YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities



Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

A FEW REPRESENTATIVE USERS OF YARWAY GUN-PAKT EXPANSION JOINTS

City of Cleveland • Georgia Power Co. • Philadelphia Electric Co. • Dayton Power and Light Co. • Jacksonville State Hospital • Univ. of California • Agfa Ansco Corp. • Armstrong Cork Co. • Chrysler Corp. • General Motors (Buick Div.) • Westinghouse Electric Co. • Central Heating Plant, Washington, D. C.



LOW COST DEPENDABLE COAL HANDLING FOR PUBLIC UTILITIES

Salem Gas and Light Company, Salem, Mass., found a G-W Skip Hoist the ideal solution to the problem of conveying coal and coke to producer storage. The skip bucket keeps the producer-storage bin filled at all times . . . and does the job with maximum economy.

Gifford-Wood Skip Hoists . . . one of many G-W systems of materials handling . . . are low in initial cost . . . low in maintenance . . . long-lived . . . completely dependable. Public utility companies the country over are becoming increasingly interested in Skip Hoist handling of coke, coal and ashes where space is limited and both initial and operating costs must be kept at rock bottom.

This particular installation may not be the perfect solution to your own particular problem. Gifford-Wood, however, has specialized in the design, engineering and installation of all types of materials handling systems for 136 years. To have a Gifford-Wood Materials Handling Engineer survey your present method of moving materials, places you under no obligation and it may well be your first step toward lower operating costs and increased production.

GIFFORD-WOOD CO.

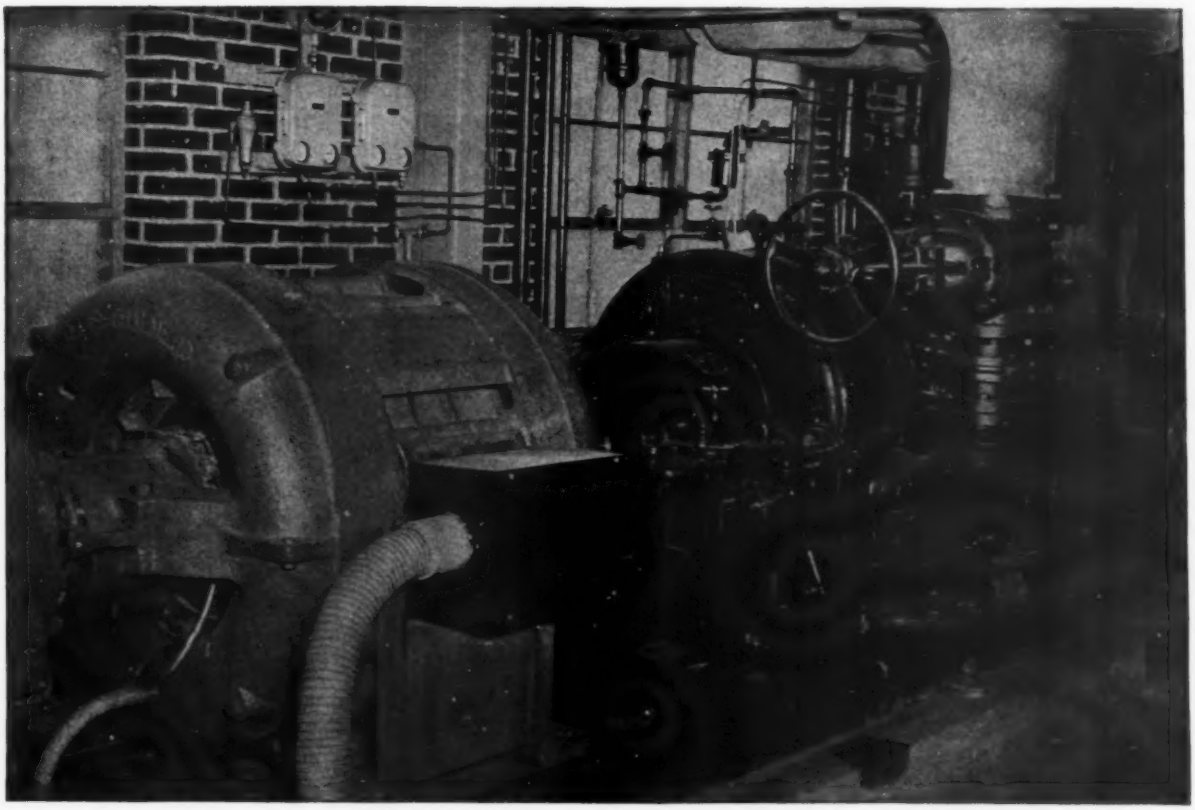
Since 1814
HUDSON, NEW YORK

NEW YORK 17, N. Y. 420 WASHINGTON AVE. • ST. LOUIS 1, MO. RAILWAY EXCHANGE BLDG. • CHICAGO 6, ILL. 565 W. WASHINGTON ST.

6616

When You Think of Materials Handling — Think of Gifford-Wood

The TERRY TURBINE



For By-Product Power and Steam Balance

This 200 kw Terry Turbine driven generating unit operates in parallel with other generating equipment, the load on the unit being adjusted in accordance with the demands for exhaust steam. It is a single stage axial-flow, type, 4500/1200 rpm, 160 psi, 0 superheat, 5 psi back pressure, equipped with Terry reduction gears, oil-relay governor, motor synchronizer and back-pressure regulator.

The installation pictured above is typical of many special applications of Terry Steam Turbines, each designed for specific requirements.

Any of our district representatives will gladly give you full information on a turbine to meet your requirements, no matter how special they may be.

No obligation, of course.

T-1176

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

All These Were Once
DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations. RC-116

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

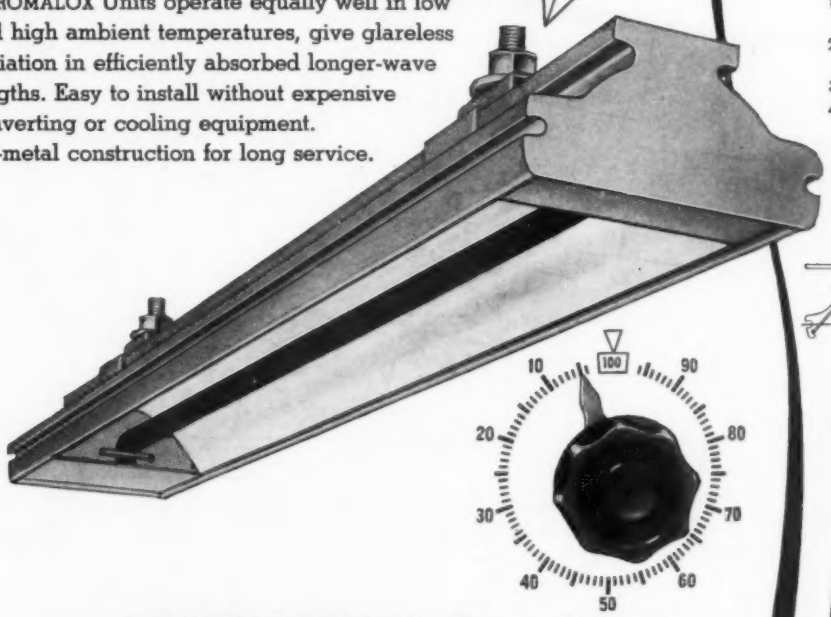
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

Uniform, EXACT *infrared heat*

at the **turn** of a dial

You can "dial" the exact uniform heat you need to fit the job in infrared drying, baking, preheating, curing, dehydrating and similar applications when you use CHROMALOX Electric Radiant Heaters. Compact CHROMALOX Units operate equally well in low and high ambient temperatures, give glareless radiation in efficiently absorbed longer-wave lengths. Easy to install without expensive converting or cooling equipment. All-metal construction for long service.



CHROMALOX Radiant Heaters

trouble-free All-metal unit withstands shock, vibration, dust, blows and rough handling. Not affected by splashed liquids; nothing to shatter.

flexible heat Precise temperatures at the turn of a dial, easily regulated for changed working requirements. Ovens can be zoned for stepped-down heat.

color-blind Chromalox Radiant Heat ignores color variations; longer-wave length infrared is absorbed equally by all colors, textures, surfaces.

uniform heating Light, dark or multicolored work may be processed simultaneously. Proper heater positioning assures an even blanket of heat without hot-spots.

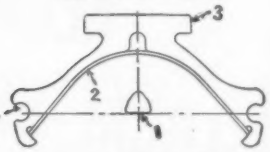
CHROMALOX

Electric heat for modern industry

Only **Chromalox** Radiant Heaters offer these features

•

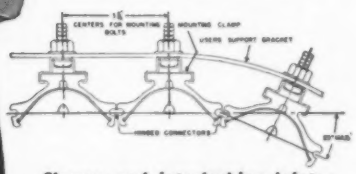
ALL-METAL DESIGN



1. Inconel-sheathed Chromalox triangular heating element.
2. Highly polished, non-oxidizing reflector.
3. Rigid, extruded metal housing.
4. Interlocking connector for assembling banks of heaters.

•

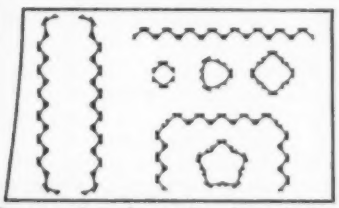
QUICK, EASY INSTALLATION



Clamps and interlocking joints simplify assembly of units into ovens, banks, tunnels, etc.

•

VERSATILE APPLICATION



Cross-section views of a few of the many oven designs possible with Chromalox Radiant Heaters.

For more Know-How— Send for complete Application File

It shows you how many others are saving time, and increasing production with Chromalox Radiant Heaters.

IC-48

EDWIN L. WIEGAND CO.
7520 Thomas Boulevard
Pittsburgh 8, Pa.

Yes . . . send me the application file on Chromalox Radiant Heaters

Name_____

Company_____

Street_____

City_____ Zone____

State_____

wherever you are...

ALEMITE OFFERS LOCAL SERVICE & SUPPLY

Over 1700 Alemite Service and Supply Centers Assure You Quick, Efficient Service—On the Spot!

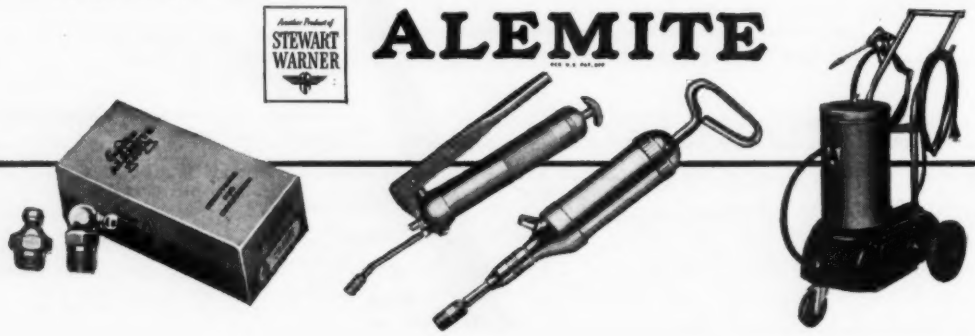
That's why Alemite customers from coast to coast save time, trouble and money—*daily!* They depend and call upon this vast, national network of experienced lubrication specialists. And so can you!

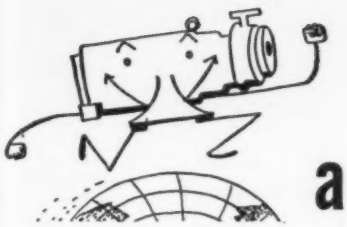
Every Alemite Service Center is staffed by qualified personnel, ready to offer experienced counsel and rapid aid on any lubrication problem you face. Fast, on-the-spot service is a *habit,* not an occasion, with these local Alemite branches, distributors and service jobbers. They are equally "at home" with maintenance, repair or supply problems. And they know what "hurry" means!

Write today for the name and address of your nearest Alemite representative. Address your proposal to Alemite, Dept. M-70, 1850 Diversey Parkway, Chicago 14, Illinois.

Another Product of STEWART WARNER

ALEMITE





Covers a Lot of Ground

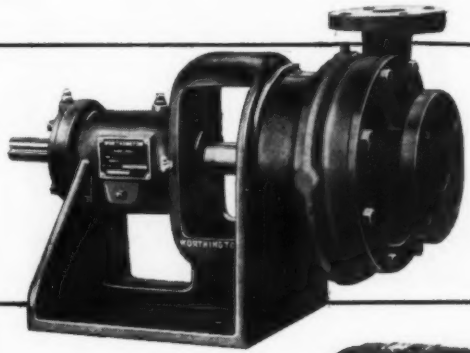
You can't find anything so certain to fit your exact requirements in a pump . . . as the Worthington standard centrifugal.

The types CN and DN really cover the waterfront—and all other "fronts." Capacities from 10 to 1800 gpm. Heads to 535 ft. 40 sizes of pump casings. 200 combinations of frame-mounted designs. Altogether, over 10,000 standard combinations to choose from.

And still—there's maximum interchangeability of parts!

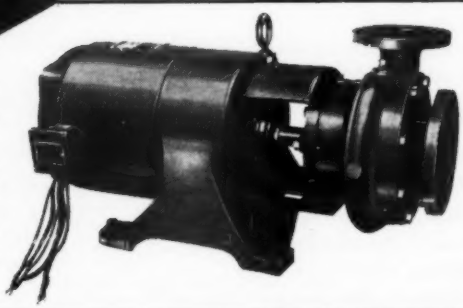
We have just your size

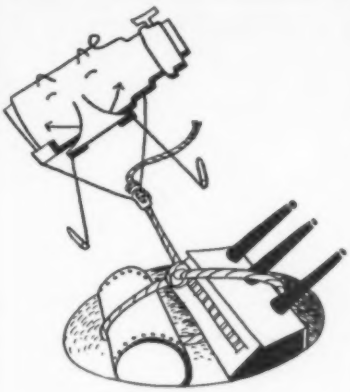
From this vast selection you're sure to find the one right pump for you. That means the end of compromising with pumps that are *not* just right—and the beginning of the money-saving performance proving *there's more worth in Worthington!*



Type CN, frame-mounted, is a real "any-drive" pump—readily driven by electric motor, V-belt, or any other mechanical power source.

Type DN is the famous Worthington Monobloc design—compact, streamlined, with built-in motor. On both types, liquid ends are interchangeable, and can be equipped with either conventional packing or mechanical seal.





Pump Pulls Boiler and Mill Out of Hole

A paper mill customer of Turner Supply Company, Mobile, Ala., having installed new equipment, couldn't operate it due to delay in delivery of a new boiler. While the existing boiler could be operated at the higher pressure required, the boiler feed pump in use was inadequate.

Turner Supply Company, a Worthington distributor, furnished from stock a pump which, when connected in series with the old pump, permitted the mill to operate the old boiler at a higher pressure. This arrangement was used for over three months, allowing the mill to make use of expensive new equipment before the new boiler was ready for service.

Remember—no distributor offers more pumps . . . no distributor offers more value in pumps . . . than a Worthington distributor.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
PUMP AND COMPRESSOR MERCHANDISING DIVISION
Harrison, New Jersey

The Good Right Hand of Industry

POWER TRANSMISSION: sheaves, V-belts, variable speed drives.

PUMPS: centrifugal, power, rotary, steam.

AIR COMPRESSORS: water-cooled, air-cooled.

PC.O.7

Worthington Pump and Machinery Corp.
Pump and Compressor Merchandising Div.
Harrison, N. J.

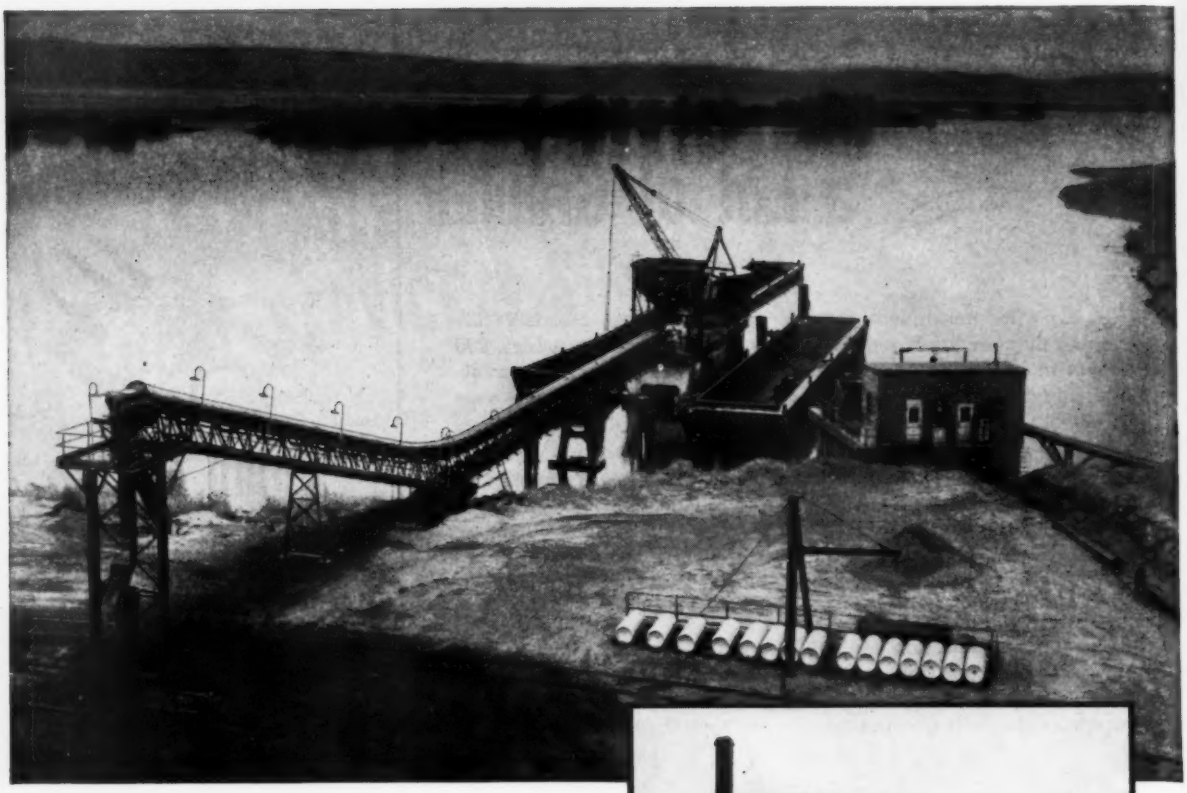
Send latest bulletin on Worthington Centrifugal Pumps. Any other (type).....

Name.....

Company.....

Address.....

City.....State.....



Barges to Bunkers —No Hands!

In this case, coal had to move from river barges and rail cars to storage bunkers in the power house. Outdoor storage with conveying equipment to quickly reclaim coal was also a must. A single system had to do the job fast at lowest cost per ton. An S-A engineered system is easily meeting every requirement.

S-A engineers draw upon almost half a century of experience in bulk materials handling. In almost every kind of industry, they are continually designing and installing systems that increase the efficiency and lower the cost of coal and ash handling.

Take advantage of this experience. Ask *first* for the recommendations of S-A engineers to assure yourself of maximum efficiency in handling equipment for your bulk materials. There's no obligation, so write today.

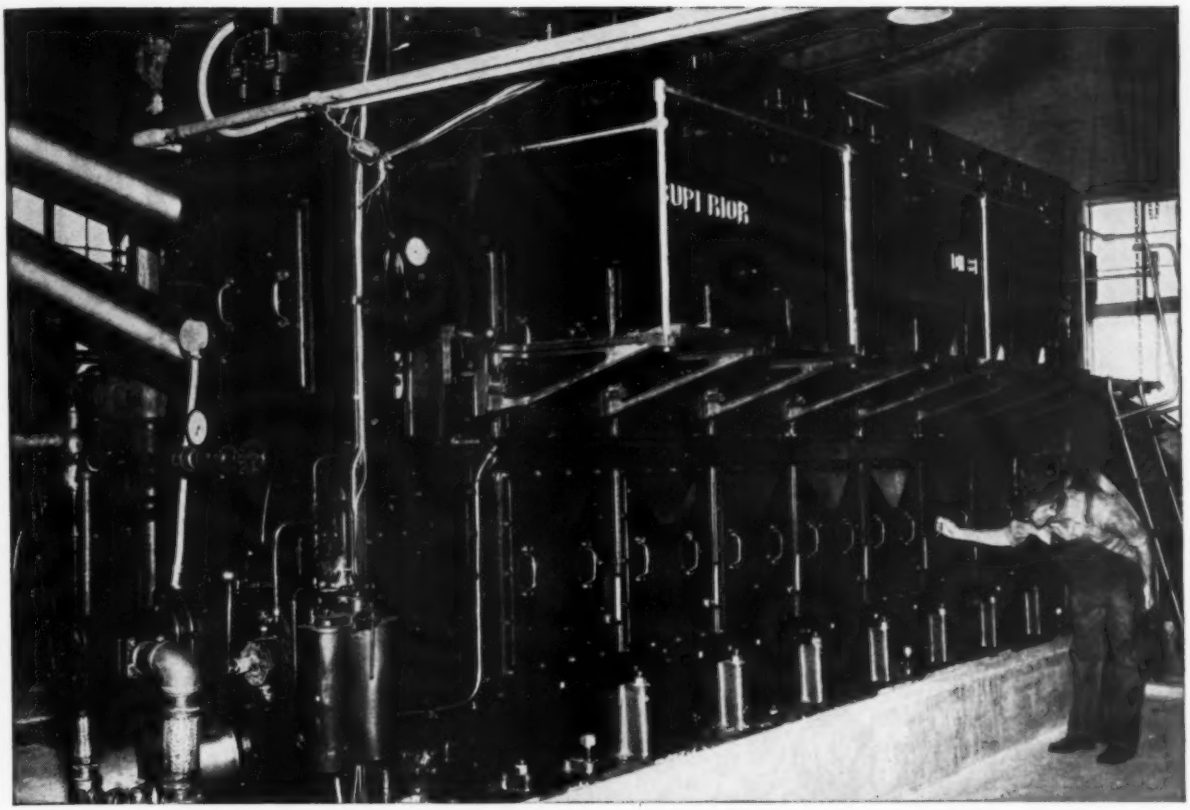
INTERSTATE POWER CO.
LANSING, IOWA

Swivel-mounted grab-bucket crane unloads coal from barges on either side of unloading pier. At transfer point, coal can be loaded on rail cars or dumped in track hopper from which reciprocating feeder supplies a 275 ft. long belt conveyor to junction house. There, coal is either chuted to outdoor storage or fed to inclined belt to top of boiler house. Horizontal belt conveyor runs over bunkers and belt tripper discharges coal to bunkers. Tractor drawn carry-all spreads coal over entire outdoor storage area and reclaims it to track hopper. System handles coal at 100 TPH.

STEPHEN S-A ADAMSON MFG. CO.

21 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



How Superior's Dual Fuel Feature Saved $10,000 in Six Months

Folks in a Nebraska town opened the door to lower power costs with a Dual Fuel Superior Diesel. By operating on gas, this Model 80 Dual Fuel Superior saved approximately $10,000 in fuel in six months. What's more, maintenance costs are staying at a low level even when gas is used.

As a result of these substantial savings, this Nebraska town ordered another Model 80 Superior Diesel. This engine is also capable of developing 1440 HP with 1000 KW capacity at 360 RPM on *either oil or gas.*

It's easy to switch from oil to gas or from gas to oil with a Superior. It can be done instantly . . . with a flick of a finger . . . all the operator has to do is push a button.

Our representative can give you all the details on this and other successful Superior installations. Chances are he can help you accomplish the same results. Just write and tell us when he should call or, if you prefer, send for a fully illustrated booklet.

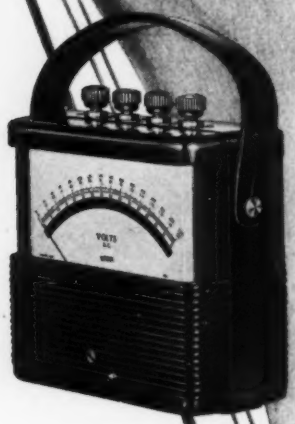
THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

TO KEEP Ahead of Trouble



Self-shielded, easily read, Weston Model 901 Portable Instruments tolerate wide temperature fluctuations, stay accurate to ½ of 1%.

When the warning flags are flying it pays to be prepared, at sea or ashore. To keep ahead of trouble on your electrical equipment, rely on Weston Instruments to warn of approaching trouble . . . to isolate circuit faults . . . to assure trustworthy repairs. Weston Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey.

For accurate circuit analysis, use the ultra-sensitive Weston Model 785 Industrial Circuit Tester. It provides 28 AC and DC voltage, current and resistance ranges.

All AC and DC requirements are met by the extensive Weston line of Panel and Switchboard Instruments.

Measuring voltage and current on insulated or bare conductors is quick and easy with the Weston Model 633 AC Clamp Volt-Ammeter.

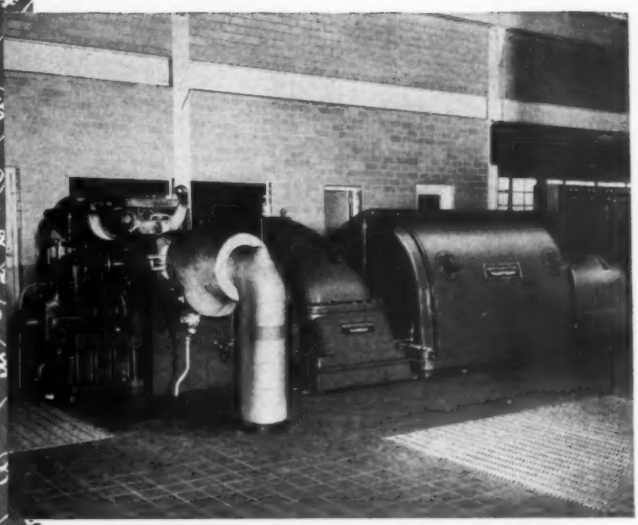
WESTON *Instruments*

Albany • Atlanta • Boston • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Jacksonville • Knoxville • Little Rock • Los Angeles • Meriden • Minneapolis • Newark • New Orleans New York • Orlando • Philadelphia • Phoenix • Pittsburgh • Rochester • San Francisco • Seattle • St. Louis • Syracuse • Tulsa • Washington, D. C. • In Canada, Northern Electric Company, Ltd., Powerlite Devices, Ltd.

FACTS ABOUT THE

Most Profitable Turbine Generator Investment

YOU CAN MAKE...



One of two Worthington 4000 kw turbine generator sets installed in a mid-western municipal power plant, operating on 600 #G and 750 F.T.T. Steam exhausting to 28" Hg vacuum.

Worthington's Experience and Undivided Responsibility Assure Low Cost, Dependable Power

Builders of steam turbines for over 30 years, Worthington's Steam Turbine Division is backed by the experience and resources of the entire Worthington organization — recognized leaders in the power plant field for more than a century. In view of today's increased turbine pressures and temperatures — and the resulting needs for new and special materials — this vast, combined source of technical knowledge has proved of tremendous practical value in developing turbine design, construction and performance.

Generators Are Worthington's, Too

The generators used with Worthington Turbines are built by a Worthington subsidiary that has specialized in this field for over 45 years. This means that Worthington, as manufacturers of *complete* turbine generator units, assumes *undivided responsibility* for the coordinated design, assembly and performance of these units.

Before shipment, Worthington Turbines and Generators are assembled together *as units* for testing and adjustment — eliminating the necessity for doing this after installation. Also, for installation and service, Worthington turbine specialists and regular Worthington service men are always available from our District Offices throughout the country.

Check These Over!

Adding up, Worthington's matchless power plant experience . . . huge manufacturing facilities . . . long specialization in both turbine and generator manufacture . . . .undivided unit responsibility . . . and skilled technical service . . . are the best assurance you can get anywhere of efficient, economical steam turbine power.

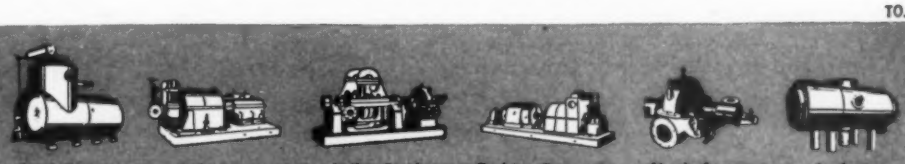
Worthington makes turbines in a wide range of sizes and types, each one designed to make steam do more work. For details proving *there's more worth in Worthington*, contact your nearest Worthington representative. Or write to *Worthington Pump and Machinery Corp., Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

TO.2

A GREAT TEAM IN STEAM



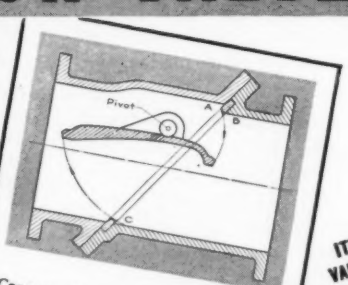
HOW MUCH DOES SLAMMING COST YOU EACH YEAR?

CHAPMAN TILTING DISC CHECK VALVES

Take just a moment to figure how much the slamming of ordinary check valves is costing you in extra maintenance. You'll find it's *plenty!*

Then switch to Chapman Tilting Disc Check Valves. You'll eliminate the slamming that causes those destructive pipe line stresses. Most of the wear on seats and hinges, too. And head losses will be almost 80% lower than for conventional type check valves.

Those features mean important savings. Yet there are many more. Write today for additional information.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

IT'S THE VALVE WITH CUSHIONED CLOSING!

The Chapman Valve Mfg. Co. INDIAN ORCHARD, MASSACHUSETTS

we'll take th "Red Ink" out of your

mot hop

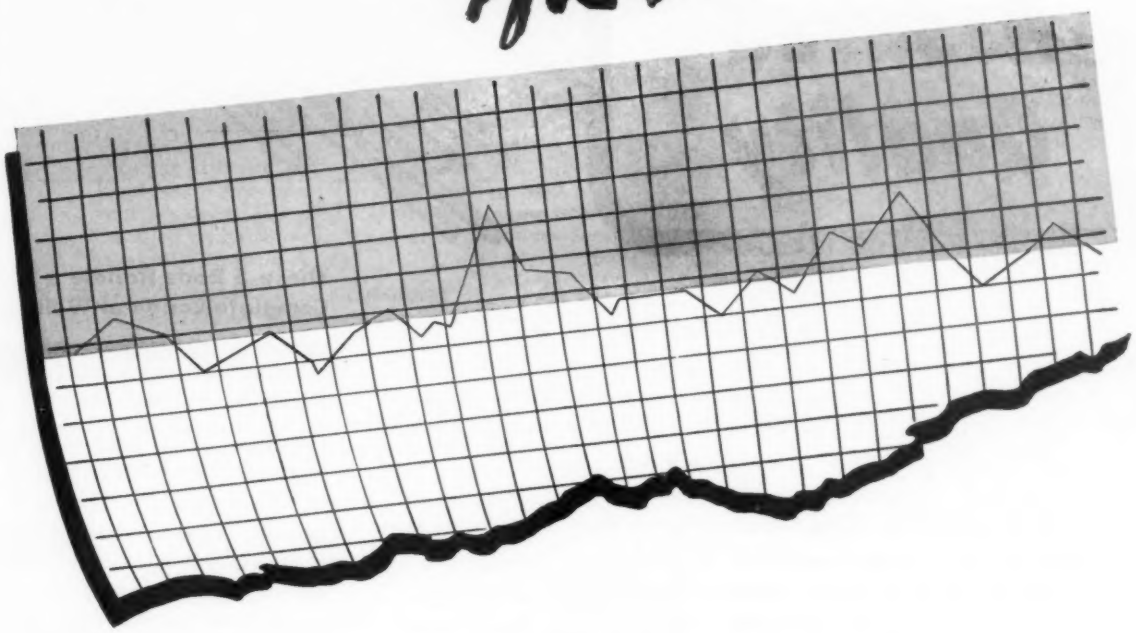
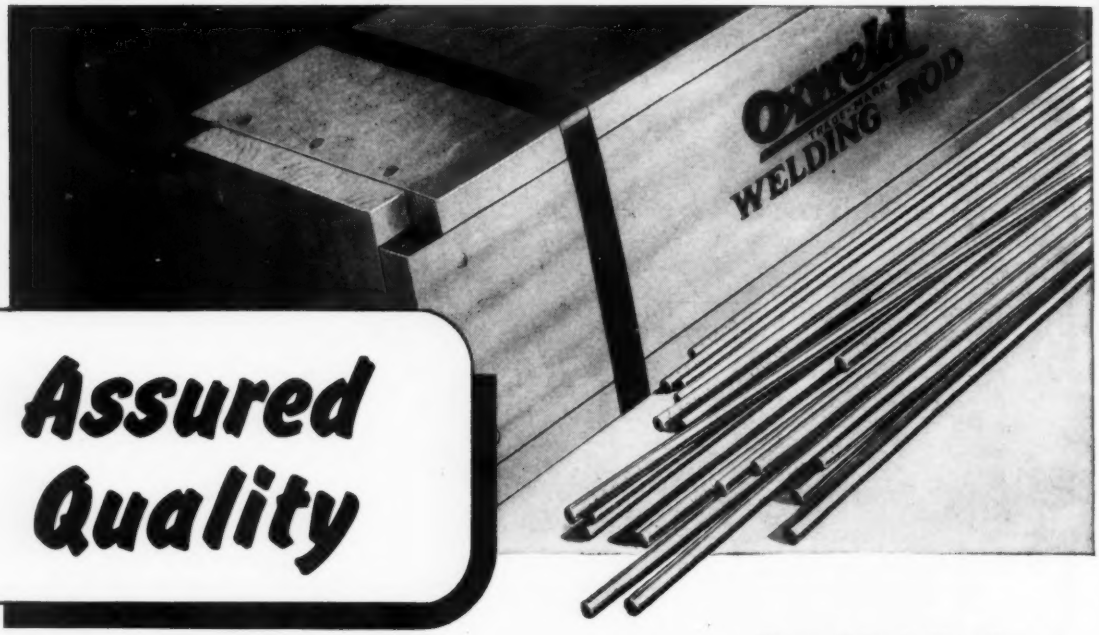


Chart the week-to-week demand and the week-to-week costs of your motor maintenance-repair shop and you'll find that the red ink is concentrated at the periods of peak demand. Normally, the shop probably operates efficiently. But the peak demands cost overtime, and rushed, slighted work. To overcome that condition you'd have to over-equip and over-man your shop. And that means higher cost every day. Many industrialists and generating plants, on the other hand, are operating such shops with very high efficiency. They are equipped and manned to handle the normal demand; they turn over the peaks — the red ink jobs — to us. Thus they avoid the vicious circle of excessive labor costs and excessive overhead. They get work, too, comparable to the best they can do themselves. We've done so much industrial and electrical utility work we know how; we're efficient; our costs are low. That means *your* costs are low, both in your shop and in ours. Our engineers will be glad to come to your office to suggest experienced ways and means of taking the top costs out of *your* motor and generator work. Just drop us a line for quick action.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U.S.A.



Assured Quality

The quality of any weld—its strength, ductility, grain structure, machinability, surface finish—depends largely on the rod used to make it. Only the best rods consistently give good welds of uniformly high quality. Only the best can help you to weld better and faster at lower cost . . . and help to make your job easier, too.

There are two good reasons why OXWELD Welding Rods are the best that modern science knows how to make. First, their rigid specifications are carefully worked out in LINDE research laboratories, which are among the largest and best equipped in the world. Second, LINDE engineers at production points constantly check during manufacture to see that the rods conform to these specifications.

They inspect ingots and billets, sample heats for chemical analysis, make flame and weldability tests, weld and test coupons for strength and ductility. In short, every known precaution is taken to maintain a uniformly high standard.

Every OXWELD Welding Rod that goes to market is of proved physical and chemical analysis . . . free from all objectionable properties and impurities. The OXWELD trade-mark is your guarantee of quality and satisfaction.

The terms "Oxweld," "Prest-O-Weld," and "Purox" are registered trade-marks of Union Carbide and Carbon Corporation.

Order from your local Jobber

There's a PREST-O-WELD or PUROX Jobber nearby to serve you promptly. If you don't know him now, write us. The Linde Air Products Company, 30 E. 42nd St., New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

These 5 Rods Handle a Complete Range of Welding

OXWELD NO. 1 H.T.

OXWELD No. 1 H. T. Steel

For all high-strength steel welding. Develops tensile strengths 11,000 lb. per sq. in. higher than ordinary steel.

OXWELD NUMBER SEVEN

OXWELD No. 7 Drawn Iron

A remarkably ductile, copper-coated rod for all run-of-shop steel welding on materials up to ¼-inch thick.

OXWELD NO. 25 M. BRONZE

OXWELD No. 25M Bronze

A superior rod for all braze-welding, building up wearing surfaces, and fusion welding of copper alloys.

OXWELD NO. 23

OXWELD No. 23 Aluminum

For all-purpose welding of aluminum and its alloys. Prevents weld cracking by absorbing cooling stresses.

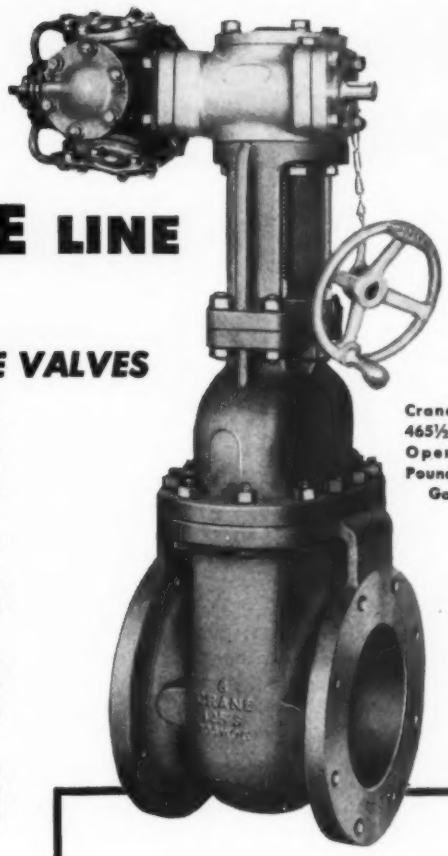
OXWELD No. 9 Cast Iron

An ideal rod for fusion welding gray iron castings. Weld metal is fine-grained, soft, and easily machined.

9 additional welding rods and 8 hard-facing rods for more specialized work.

ANSWER TO A SPECIFIC NEED NOW IN THE CRANE LINE

NEW, LOW-COST FLUID-MOTOR OPERATED GATE VALVES



Crane 8-inch No. 465½ Fluid-Motor Operated 125-Pound Iron Body Gate Valve.

These valves fill the need for a power-actuated pipe line control at lower than usual cost. By utilizing a simplified fluid motor, they permit wider application of mechanically-operated valves to increase plant efficiency.

Low in first cost . . . low in operating cost . . . Crane Fluid-Motor Operated Valves save labor, help prevent accidents and offer definite advantages when installed on hard-to-reach valves or on valves used in timed operating cycles.

OPERATE AT LOW COST—Crane Fluid-Motor Operated Gates utilize pressure sources readily available in most plants—compressed air, water, or oil . . . at pressures ranging from 40 to 300 psi.

HIGH STARTING TORQUE—Motor is reversing type and is designed to exert greater torque when unseating the valve than when seating it. Added power to open valve against sticking is assured.

NO WASTE OF POWER . . . NO LOSS OF FLUID—Pressure-tight motor stalls when disc is in fully open or closed position. Motor can remain stalled indefinitely . . . under full pressure . . . with no leakage of operating fluid. No power is wasted in maintaining fluid at proper operating pressure.

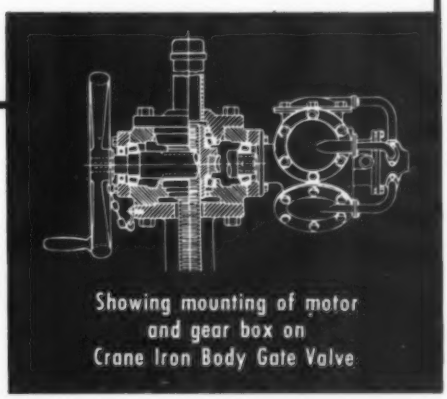
Crane Fluid-Motor Operated Valves are now available in the following pressure classes, types and sizes:

25-pound wedge disc gate	**12-in. to 30-in.**
125-pound wedge disc gate	**5-in. to 20-in.**
25-pound double disc gate	**10-in. to 30-in.**
100-pound W.O.G. double disc gate	**6-in. to 24-in.**
A.W.W.A. double disc gate	**4-in. to 20-in.**
Pulp Stock Valves	**8-in. to 20-in.**

How Crane Fluid-Motor Works

Radial-type motor has five diaphragm sealed chambers. Operating fluid, admitted through a 4-way distributing valve, acts against diaphragms to exert force against pistons. The pistons, in turn, transmit the thrust to an eccentric which causes drive shaft to rotate. Hammerblow device in gearbox allows motor to attain speed before loading and provides impact to overcome friction of valve parts.

Send for this descriptive folder—See how Crane Fluid-Motor Operated Gate Valves can help increase the operating efficiency of *your* plant. Ask your Crane Representative for your copy, or WRITE FOR FOLDER AD-1803. No obligation.



Showing mounting of motor and gear box on Crane Iron Body Gate Valve

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

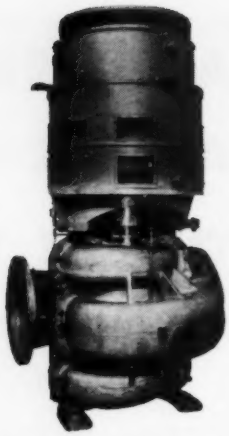
EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

Longer life in severe service from

MONEL
"K" MONEL
PUMP PARTS



24-inch main condenser circulating pump with a capacity of 15,000 g.p.m. at 25-foot head. Shafts are heat-treated "K" Monel.

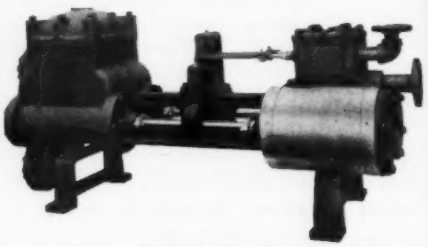
Corrosion, erosion, wear, fatigue . . . pump parts must stand up to *all* these destructive forces if satisfactory service is to be achieved.

In particular, where corrosive liquids must be handled . . . salt water, crude oil, chemical solutions . . . the selection of proper materials often spells the difference between weeks and *years* of service.

Leading makers and users of pumping equipment have found that pump life can be greatly extended, often tripled and quadrupled, when vulnerable parts are made of *Monel*® or *"K"*® *Monel*.

These two INCO alloys are highly resistant to corrosion by salt water and most commonly-encountered industrial chemicals. In addition, they possess strength and hardness equal to those of structural steel. Both alloys are machinable, and both are available in standard mill forms. Moreover, Monel is readily castable.

"K" Monel differs from *Monel* in that it may be heat-treated to attain maximum properties, either before or after machining. This feature makes *"K" Monel* an ideal metal for shafts, sleeves, and other highly stressed machine members, while *Monel* is at its best in impellers, valve parts, strainers, and piping.

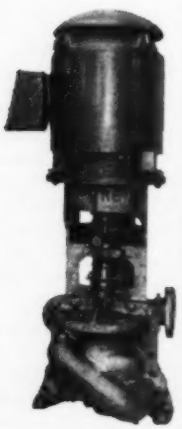


Horizontal duplex low-pressure feed pump, 7½ in. by 5 in. by 10 in. Operating pressure is 250 psi. Piston rods and valve rods are Monel.

The International Nickel foundry at Bayonne, N. J., has been casting Monel pump parts for more than 40 years. Among recent technical advances is an improvement in the as-cast surface of sand castings. Shrouded impellers, for example, are now cast with a surface so smooth that pump manufacturers report up to 75 per cent less labor time required for hand filing. The Inco foundry can also supply centrifugal castings for shaft sleeves, cylinder liners and pump rings.

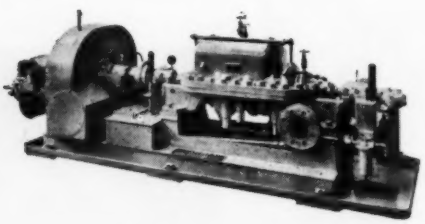
For further information on cast Monel impellers and other Monel pump parts, write to R. F. Johnson of INCO. Ask for your copy of *"How to Get Longer Service from your Pumps."*

3-inch main condensate pump handling 225 g.p.m. at a head of 180 ft. Impellers are Monel, cast at Inco's Bayonne foundry.

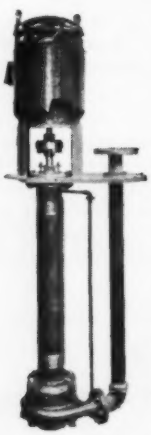


THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

All pumps illustrated were manufactured by: WARREN STEAM PUMP COMPANY, INC. Warren, Mass.



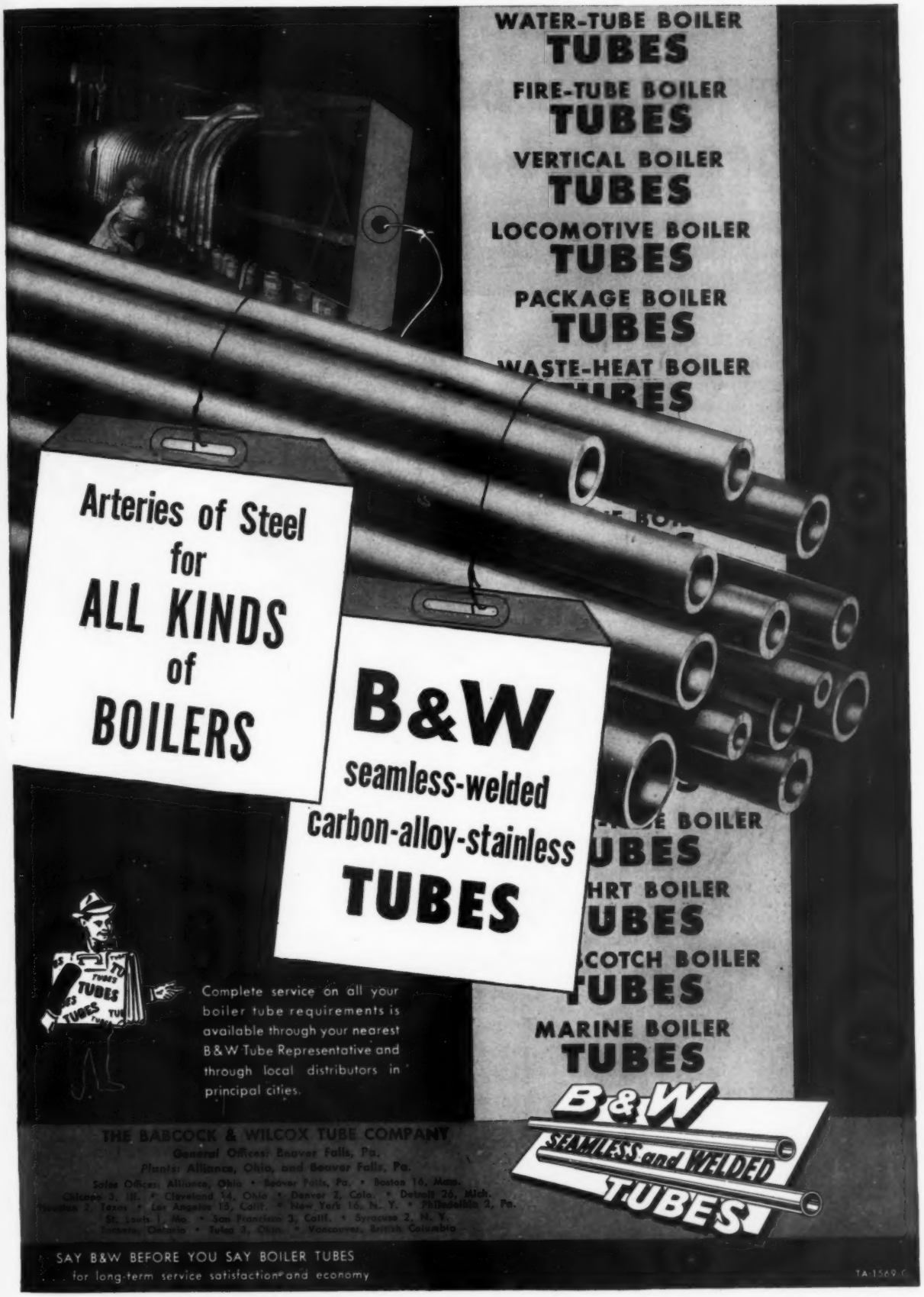
2½-inch, six stage feed pump, driven by a 210 H.P. turbine. Pump delivers 300 g.p.m. of feed water at a discharge pressure of 725 psi, equivalent to a head of 1770 ft. Shaft sleeves are Monel. Impellers are cast Monel, produced by Inco's Bayonne foundry.



2-inch condensate and drain transfer pumps, handling 100 g.p.m. at a 140-ft. head. Cast Monel impellers were produced by Inco's Bayonne foundry.

EMBLEM OF SERVICE
INCO
TRADE MARK

MONEL . . . *for Minimum Maintenance*

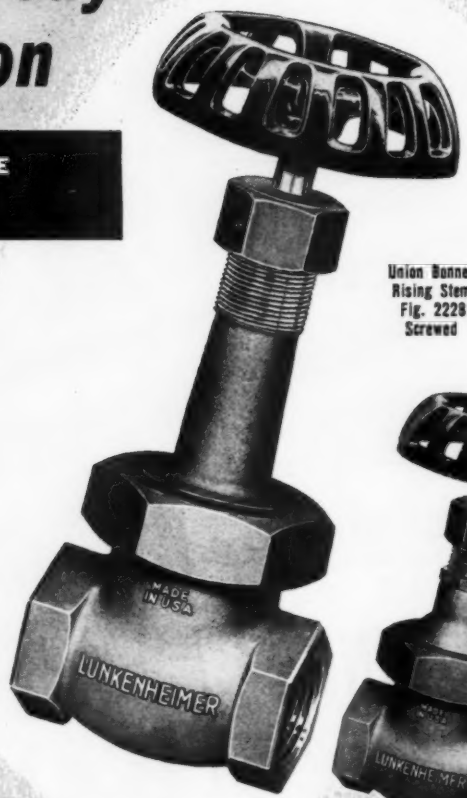

WATER-TUBE BOILER
TUBES
FIRE-TUBE BOILER
TUBES
VERTICAL BOILER
TUBES
LOCOMOTIVE BOILER
TUBES
PACKAGE BOILER
TUBES
MARINE BOILER
TUBES
Arteries of Steel
for
ALL KINDS
of
BOILERS
B&W
seamless-welded
carbon-alloy-stainless
TUBES
Complete service on all your boiler tube requirements is available through your nearest B&W Tube Representative and through local distributors in principal cities.
THE BABCOCK & WILCOX TUBE COMPANY
General Offices: Beaver Falls, Pa.
Plants: Alliance, Ohio, and Beaver Falls, Pa.
B&W
SEAMLESS and WELDED
TUBES
SAY B&W BEFORE YOU SAY BOILER TUBES
. . . for long-term service satisfaction and economy
TA-1569-C

The cylindrical body defies distortion

LUNKENHEIMER FIG. 2228 LINE
UNION BONNET GATE VALVES

In this design of 200 lb. S. P. Bronze Union Bonnet Gate Valves, Lunkenheimer incorporates the first application of full cylindrical body sections in bronze gate valves. This construction, previously used only in higher pressure steel valves, provides great strength and maximum resistance against distortion of the valve body and seats due to internal pressure strains and other stresses. Tests made under conditions far more severe than those encountered in actual service prove that this design will not distort and will maintain initial proportions and seat tightness.

In addition to the cylindrical body construction and other service-giving features, the valves are equipped with stems made of the distinctive silicon bronze alloy developed by Lunkenheimer to eliminate stem-thread failure due to wear.



Union Bonnet Rising Stem Fig. 2228 Screwed

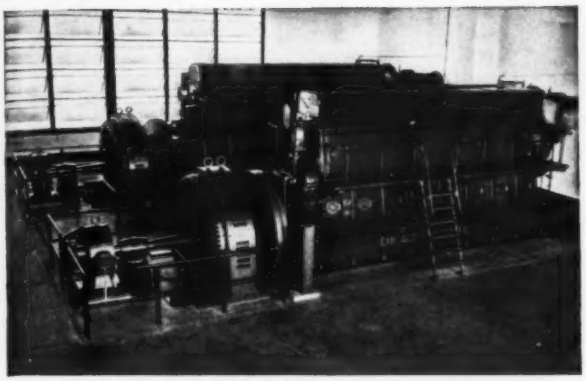
Union Bonnet Non-Rising stem Fig. 2230 Screwed

Your Lunkenheimer Distributor will gladly show you how this valve's extra strength means extra service, extra value, too! Ask for Circular 534 or write direct.

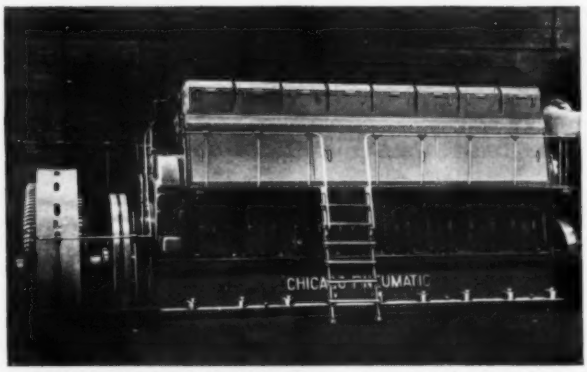
O. S. & Y. Union Bonnet Rising stem Fig. 2232 Screwed

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U.S.A.
NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34
EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

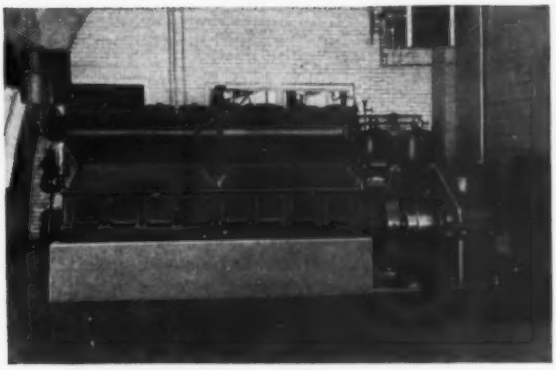
CP medium and slow speed Diesel Engines



Two CP 1500 H.P. Diesels in a western public utility station.



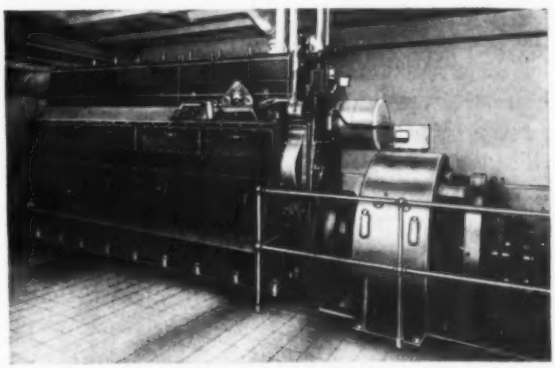
CP 1650 H.P. 8-cylinder Diesel in well known industrial plant.



CP 400 H.P. Diesel in petroleum pipeline station.

Available in sizes ranging from 120 H.P. to 1750 H.P., these engines can be furnished either for straight Diesel or for Dual Fuel operation. The CP line includes both normally aspirated and supercharged engines, all the latter incorporating the thoroughly dependable Elliott-Buchi Turbocharger.

CP Diesels have proved profitable investments for public utilities; industrial, municipal, ice and waterworks plants; and in mining, oil, pipeline, cotton ginning and other fields where low cost, dependable power is a vital necessity. Write for complete information.

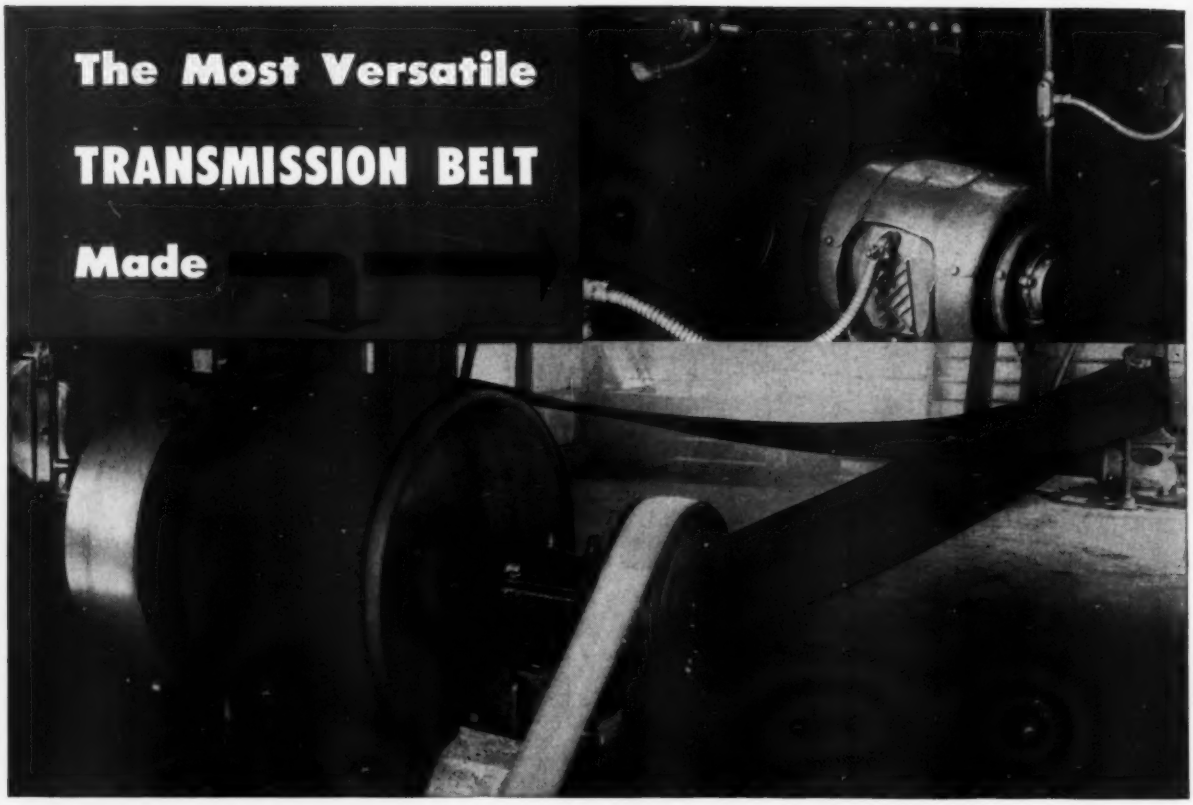


CP 640 H.P. Diesel in large laundry.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Condor Whipcord Endless Belts are Used Everywhere

. . . for long or short centers, high or low speeds, large or small pulleys, wherever endless belts can be installed. Whether light, fast drives on textile machines, or heavy duty drives on pumps or Jordans, Condor Whipcord Endless Belts save money over any other type of belt.

The foremost feature of a Condor Whipcord Endless Belt is low inelastic stretch. Manhattan engineers were the first to *pre-stretch* cords during manufacture to insure a belt that maintains its tension on the drive without constant take-up. The stout Whipcords are so impregnated with Flexlastics and protected in the body of the belt that no atmospheric conditions affect the length of the belt.

Other advantages of the Condor Whipcord Endless Belt are its outstanding flexibility, its freedom from ply separation, and no splice in the tension or load carrying section. These advantages make it the ideal belt for serpentine drives as on wood working machines.

EXTENSIBLE TIP AIDS LONG LIFE

Still another major belt value is Manhattan's patented Extensible-Tip method of splicing the cover ends. The results it gives you in longer wear are easily demonstrated. Figure A photographs the usual failure of a regular cover end splice. Figure B shows an Extensible-Tip cover end splice still intact after running 10 times as long under identical conditions. If belting is costing money in your plant, by all means have your Manhattan distributor or a Manhattan engineer show you the Patented Extensible-Tip and demonstrate the features of Condor Whipcord Endless Belts.

Keep ahead with Manhattan

RAYBESTOS-MANHATTAN, INC.

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INDUSTRIAL POWER

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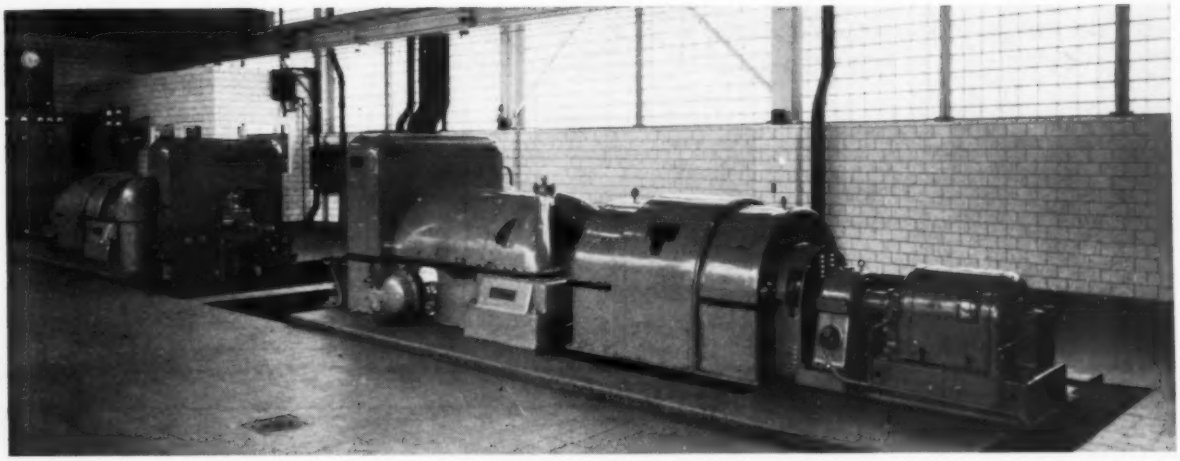


These 1,000-kw turbine generators operate on an "on-off" schedule, which calls for two weeks on the line and two weeks as a standby unit

FALLS CITY PRODUCTION NOT HAMPERED DURING RECENT DC TO AC CHANGEOVER

Changing over from d-c to a-c power, while the plant is in full swing, is always a difficult job when production gets first priority. This Louisville brewery, however, made the changeover and even increased production by operating three shifts in some departments

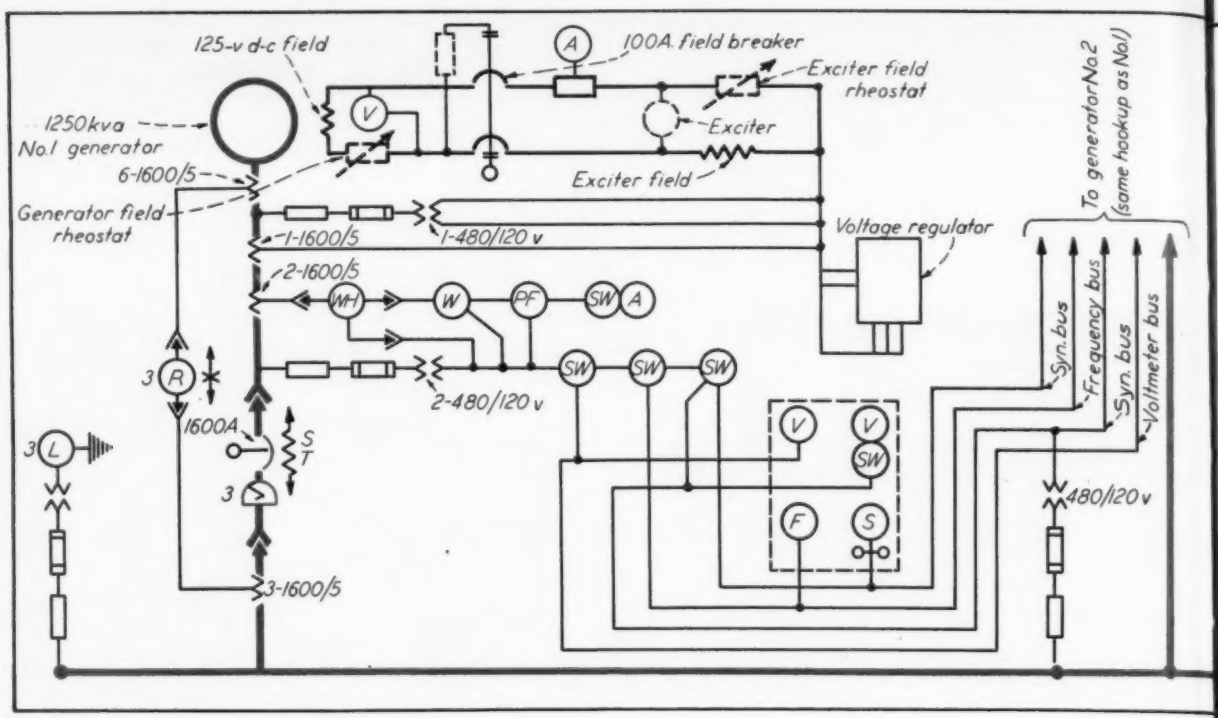
ARTHUR A. KASPAR, *Chief Engineer, Guarantee Electrical Co.*

CHANGING FROM DIRECT to alternating-current power, when production cannot be interrupted, can be a simple matter if the installation of electrical equipment has been properly planned. Engineers at the Falls City Brewery Company, Inc., made such a changeover recently while actual production continued as usual, even though this plant operated two shifts a day, seven days a week. In fact, there were several occasions when three shifts were employed to keep production ahead of customer demand.

To make this changeover possible, a new two-story structure was erected adjacent to the old plant, which will ultimately be razed to make room for factory expansion. The second floor contains two 1000-kw extraction-turbine generators, two 40,000 lb per hr boilers and the necessary auxiliaries. The latter consist of switchgear, control panel, five compressors with two 125-hp and three 175-hp synchronous motors—which raised the plant power factor to almost unity. Every effort was made in the design of this system to make the plant an up-to-date unit with the maximum of flexibility. For example, one turbine generator will operate for a period of two weeks with the idle machine acting as a standby. At the end of the two-week period the standby is placed on the line and the previously operated unit is shut down for a thorough inspection.

In addition, the switchgear is designed to use standard parts. All feeder breakers are identical and, in case of trouble, a spare breaker can be inserted without delay. This provides flexible operation and increased efficiency throughout the power plant.

Switchgear equipment consists of two main generator sections with 1600-amp



electrically-operated air circuit breakers having 50,000-amp interrupting capacity. Each section contains differential relays and protective devices for generator field excitation. One section adjacent to the switchgear equipment contains two voltage regulators. Generator operation is controlled to maintain constant 480 v, 3-phase, 60-cycle current. Both regulators are connected in parallel and while one is in service the other is available as a standby.

Feeder Breakers

All feeder breakers are rated at 400 amp, 480 v, 50,000 amp interrupting capacity, and one breaker is always available as a spare for immediate insertion in case of breaker trouble. Individual circuits distribute electricity from main breakers, located on the operating-floor level. All power-feeder circuits are 400 amp with three-phase power-distribution panels. Panels are designed for maximum load demand of the area they are to serve. Individual branch distribution circuits are connected to various pieces of electrical equipment. The lighting system is stepped down through an air-cooled transformer, 480/240/120 volt, 3 wire.

Small motors in the bottling works, ranging from 1 to 15 hp, operate such equipment as soakers, washers, cleaners, pasteurizer and capping machines. To make the distribution system flexible, two 400-amp plug-in bus ducts hang two feet below the ceiling and run the length of the shop. All motor-feeder circuits are in conduits and connect directly to the bus duct overhead. This procedure eliminates all hazards resulting from a normally wet floor condition. This same bus duct also feeds electrical equipment located on the second floor, thus the over-all installation costs were reduced considerably.

Feeders are 75 C RH type wire with moisture-resisting covering. This type of feeder installation increased wire carrying capacity with the minimum size wire and conduit. Where necessary, in refrigerated areas, special attention was given to installation of conduits. Each conduit has been completely sealed to prevent condensation and circulation of air between non-refrigerated areas.

Wire for lighting and power in explosion-proof areas is thermo-plastic. Lighting throughout the plant is fluorescent, except in the power house where special mercury and incandescent units have been installed because of the relatively high ceiling in the building.

Grounding System

Of particular interest is the grounding system for the power plant. Ground rods (1 in. by 20 ft long) are spaced at 20-ft intervals around the outside of the building foundation. The rods are driven into the ground with the top portion encased in a 12 in. dia by 24 in. tile. A 4/0 bare copper wire is connected around the periphery of the building to each of the ground rods.

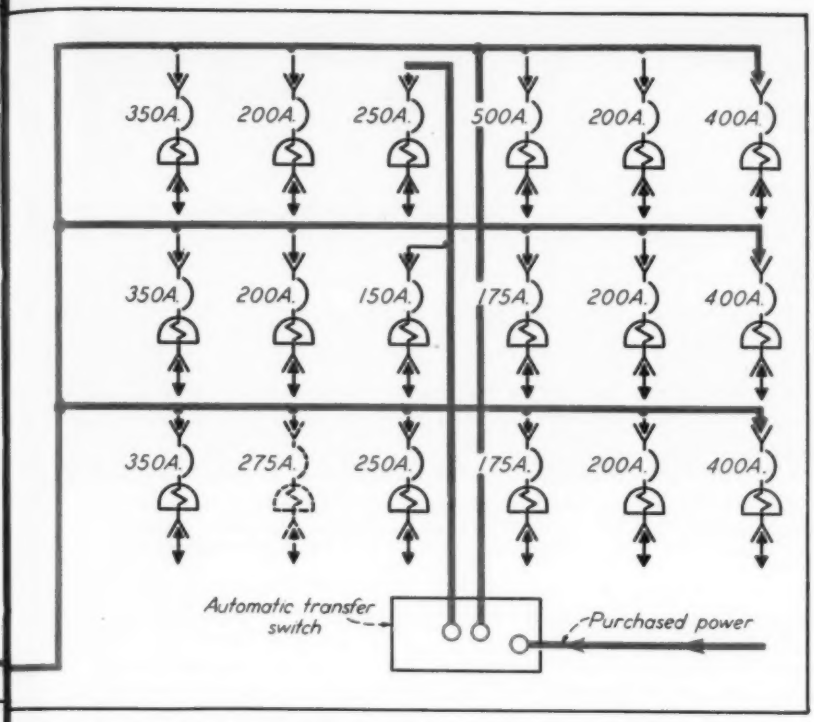
An intermediate network of ground wires passes through the foundation, and principal electrical equipment is grounded through this system. Network wires are all 4/0 size, while the grounding wire from the equipment is 1/0 and number 4 depending on the size of the machine. The network is so complete that there is no potential differential between the equipment and ground. The entire system for any circuit averages between 1 to 2 ohms.

Distribution from generator to switchgear is through 1000-v insulated cable. The 12 main leads are divided into 4 sets of 3-in. conduit. Each conduit has three 500,000 cm, type AVA, 1,000-v cables. Field current for the generator is transmitted through two 1/0 AVA wires in a 2-in. conduit.

Recording watthour meters have been installed on back of the switchboard for individual feeder circuits. The amount of power necessary for a department is recorded, and the exact amount consumed can then be prorated for a final analysis of production costs.

Each generator is rated at 1250 kva .80 power factor and 3600 rpm. Excitation is obtained from a 15-kw, 125-v, d-c, 120-amp direct-connected exciter. The turbine is designed to operate at 400 psi and 600 F TT. Extraction at 50 psi is used for all processing work with a small amount utilized for feedwater heating.

To obtain a power factor of almost unity two twin air compressors are



Generators and department branches are connected with 400-amp cable at the Falls City Brewing Co. Purchased power ties into the boiler auxiliary equipment and acts as an emergency lighting standby

driven by 125-hp synchronous motors at 360 rpm. Excitation is furnished by a 3-kw, 1750-rpm exciter. In addition to the motor driven air compressors, three ammonia compressors are operated by 175-hp synchronous motors. Excitation is furnished by a 5-kw, 125-v belt driven shunt-wound exciter.

In the event of a complete outage of both generators, power can be purchased from the local power company. This power is distributed through a 300-kva transformer bank. Operation is automatic and is tied in whenever the power plant electrical output fails completely. Purchased power is utilized only to service important boiler motorized equipment such as fans, stoker motors, air-compressor motors, feedwater pumps, condensate pumps, chemical pumps and cooling-tower water pumps.

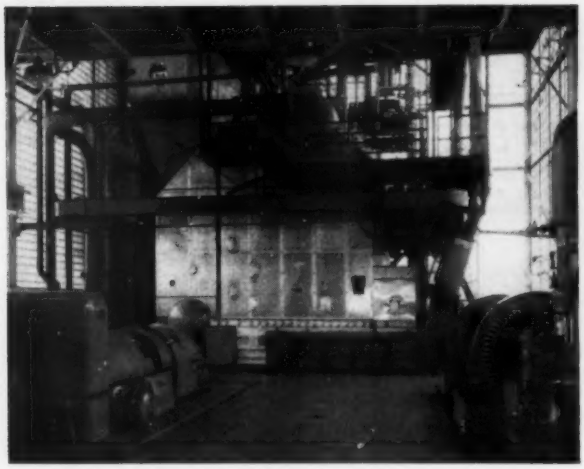
Power plant lighting system is also tied to the emergency purchased power. In case of generator trouble, the power plant will have ample lighting for repairs. In case of 480/240/120-v transformer failure, a complete battery system is kept ready for lighting service in the power plant. The battery has a normal potential of 120-v with a holding capacity of 35 hours without recharging. A rectifier keeps it at 120-v at all times. The battery normally will furnish all necessary d-c control circuits at the switchgear.

Motor Changeover

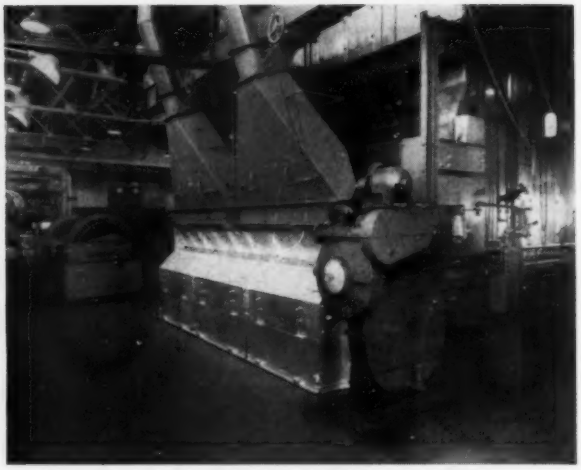
To make possible rapid changeover from d-c to a-c, all conduits and bus ducts were installed with leads brought to the motor location. To expedite changing of motors at the last minute, special plates were made; and the a-c motors were placed on these plates and bolted in position. Motor assemblies were rolled to the d-c motors they were to replace. The d-c motor was removed, and the a-c motor and special base were set on the original base and bolted into position. The electrical connections were then made and the equipment was ready for operation. Average length of time for this changeover was approximately one to two hours depending upon the size of the motor and its accessibility for installing.

Steam for all processing work, and that necessary to operate the turbine

Compact panel board has been standardized with the draw-out type switchgear; it contains identical circuit breakers, which have 50,000 amp interrupting capacity. Generator controls are at right



Cross-drum, package boilers, rated at 40,000 lb of steam per hr, float between 18,000 and 20,000 lb. Over-fired air reduces the smoke to the minimum



Pneumatically-operated stoker is fed from overhead through two non-segregating hoppers. Steam is generated at 400 psi and 600 F total temperature

generators, is furnished from two 40,000 lb per hr normal capacity boilers operated at 400 psi and 600 F TT. They can develop 44,000 lb per hr for a 2-hr period. The units are completely water-walled and have an integral furnace, which is stoker fired. An overfire air system, which keeps smoke at a minimum, consists of an overdraft with air taken from the power house space and blown through nozzles at a comparatively low velocity.

Forced and Overdraft Air

Forced-draft air—brought in from the outside—is heated before it enters the furnace. Induced-draft fans were installed after the system was in operation and are used only when furnace pressure becomes too high. Overdraft, forced-draft and induced-draft air is furnished by dual equipment. The three systems have two identical blowers, one motor operated, while the other is driven by a steam turbine extracting at 50 psi when operating at 400 psi.

Approximately 90% of the steam is utilized by the turbines, while the other 10% goes through a desuperheating station and blends with the 50-psi steam exhausted from the turbines.

Boiler Operation

Both boilers are operated continuously and float between 18,000 and 20,000 lb of steam per hr. Either of the boilers can furnish all the steam needed for processing and power generation. This method of operation has proved satisfactory as neither of the boilers becomes cold, and condensation does not occur on the water walls.

Western Kentucky coal is delivered by rail in bottom-dump cars, which are spotted over a dumping pit adjacent to the power plant. The coal is picked up by a Redler coal conveyor and elevated to an overhead silo. From the silo coal drops into a scale, is discharged, and moved automatically through a horizontal (sidepull) Redler into two individual non-segregating hoppers on each boiler. The silo has a storage capacity to operate both boilers for a 48-hour period. The unloading pit is large enough to hold one carload of coal, which increases total storage capacity to about 78 to 85 hours, depending on boiler load.

Coal-feeding equipment is operated by automatic pneumatic controls. Balancing of the over-fire air is done manually, and as the coal is quite consistent and uniform, this setting will not vary. The damper, therefore, was bolted in place and so far there has been no need to alter its setting.

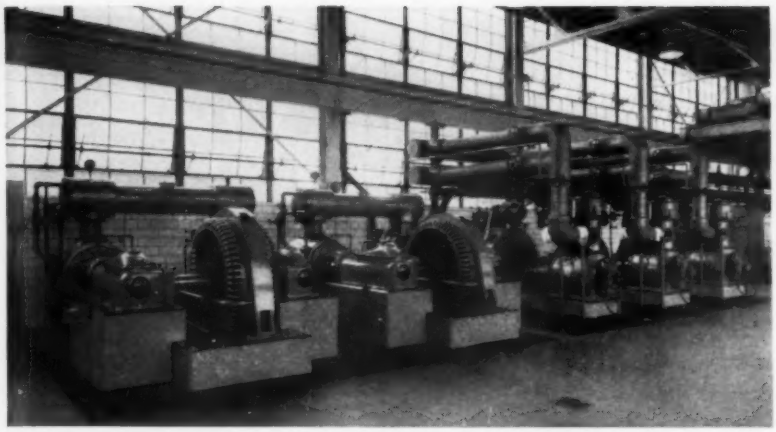
Ash is dumped from the rear of the grates and falls into a bin at the bottom of the furnace, where it is picked up by a pneumatic jet system and blown into an outside silo. The silo is elevated for unloading into open gondola railroad cars or into dump trucks. At present all ash removal has been contracted to a local hauling firm.

Boiler Feedwater

Boiler feedwater is 85 to 90% return condensate with makeup being furnished from the city mains after

PRINCIPAL EQUIPMENT IN THE FALLS CITY BREWERY CO. INC., PLANT

Turbine generator	Elliott Co.
Turbine generator exciter	Elliott Co.
Switchgear	I-T-E Circuit Breaker Co.
Voltage regulators	Ward Leonard Electric Co.
Starters & pushbutton stations	Allen-Bradley Co.
Busduct feeders	Bull Dog Electric Products Co.
400-amp feeders	The Okonite Co.
Electrical panels	Wm. Wurdack Co.
Boilers and stokers	The Babcock and Wilcox Co.
Forced-draft fan	American Blower Co.
Forced-draft-fan turbine	Elliott Co.
Forced-draft-fan motor	Wagner Electric Corp.
Induced-draft fan	Buffalo Forge Co.
Induced-draft-fan turbine	Elliott Co.
Induced-draft-fan motor	Wagner Electric Corp.
Overfire blower	American Blower Co.
Overfire motor	Wagner Electric Corp.
Coal-handling equipment	Stephens-Adamson Mfg. Co.
Deaerating heater	Cochrane Corp.
Feedwater heater	Ross Heater & Mfg. Co., Inc.
Automatic controls	Bailey Meter Co.
Boiler feed pumps	Goulds Pumps, Inc.
Boiler feed pump turbine	Elliott Co.
Boiler feed pump motor	Wagner Electric Corp.
Condensate pumps	Goulds Pumps, Inc.
Condensate pump turbine	Elliott Co.
Condensate pump motor	Wagner Electric Corp.
Water treatment	Permutit Co.
Cooling tower	The Marley Co.
Air compressors	Ingersoll-Rand
Air compressor synchronous motor	Elliott Co.
Air compressor exciter	Elliott Co.
Ammonia compressor	York Corp.
Ammonia compressor synchronous motor	Elliott Co.
Ammonia compressor exciter	Elliott Co.
Lighting transformer	Sorgel Electric Co.
Battery	Electric Storage Battery Co.
Battery rectifier	General Electric Co.



Air compressors and ammonia refrigeration equipment are driven by synchronous motors. These motors have increased the power factor to unity

passing through a zeolite softener. Feedwater is heated to 220 F in a deaerating heater by mixing it with return condensate from processing and the steam turbine. This preheated water passes through a closed heater where its temperature is increased to 265 F with 50-psi steam extracted from the turbine.

Boiler water is tested daily and the water hardness is corrected by pumping soda and phosphates directly into the boiler drums. Blowdown is continuous.

Dual Operation

Dual equipment has been installed for boiler feedwater, condensate return and condenser water. One unit is electrically operated, while the other is driven by a steam turbine operating at 400 psi and 600 F TT. In the event of a power failure, electrical auxiliary equipment, connected directly to the purchased power system, keeps the boilers on the line to supply process steam. During normal conditions pumps are driven by steam turbines, and the electrically-driven units are employed as capable standbys. This arrangement simplified original start-up of the boilers, as all auxiliary equipment was placed in operation with electricity purchased from the local power system.

Steel Sheets are Arc Welded and Pressed Hydraulically to Form 26 and 36 in. Pipe

TUBE MILL with an annual capacity of 100,000 tons of electric welded steel pipe, in sizes ranging from 26 to 36 in., started production last month in McKeesport, Pa., at the National Works of U. S. Steel's National Tube Co. Conversion of steel plates to tubes is accomplished in sixteen machines, which are the major units of the mill.

Steel plates of 0.20 to 0.30 carbon and 0.85 to 1.25 manganese are unloaded into three stock piles. Electric magnets, mounted on a remote-control trolley, feed the plates onto a conveyor leading to two end-shears. The sheared plate moves onto a run-out table and is conveyed by drag chain to a planer feed table, where it is squared-up and enters an edge-planer.

Planed and beveled plates enter another square-up mechanism and edge-forming machine, which gives a slight curve to the plate edges. From the edge-rolls the plate is fed into a "U"-ing press capable of exerting pressures up to 2,000 tons. A run-out table conveys the U-formed plate to an "O"-ing press capable of pressures up to 18,000 tons, and the plate is formed into a tube known as a "can."

By a series of conveyors and skids the can is dispatched to either of two outside submerged twin-arc a-c fusion welding machines, equipped with gas preheaters. Flux is fed from an overhead bin and after the weld, the unburned flux is picked up by vacuum and returned to the overhead storage bin. A rotating disc shears off the burned flux. Manual squirt welders assure a perfect weld, and penetration on both ends of each can is approximately 6 in.

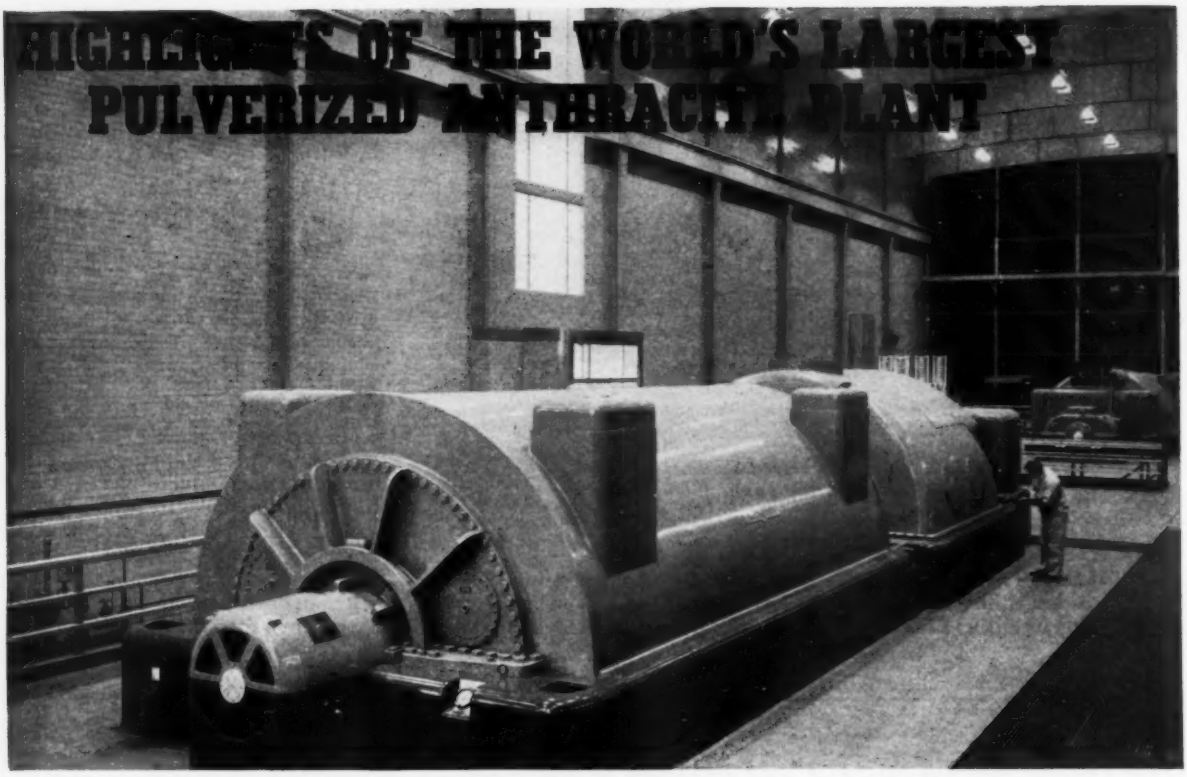
From this area the cans are fed to either of two inside welders, mounted on fixed arms consisting of d-c leading and a-c trailing arcs. The inside weld is the final operation in converting a can into a pipe section.

In the hydraulic expander, the tube ends are mechanically belled. A rubber gasket seal on the ram insures a water-tight connection. A four section die—machined to the specified finished OD—is placed around the pipe, which is then filled with water. The expander machine is capable of exerting pressures up to 3,000 psi.

Three centrifugal pumps supply water to the expander from a 25,000 gal reservoir. Pressure is applied by means of two accumulator systems, one of 3,000 lb and one of 1,2000 lb capacity. Water from the expander is drained into a sump.

Operator is positioning a "can" prior to rounding it out in this 18,000-ton hydraulic pipe-forming machine

HIGHLIGHTS OF THE WORLD'S LARGEST PULVERIZED ANTHRACITE PLANT



TURBINES *are 1,250-psig, 950-F, 75,000-kw, tandem-compound units having 5 bleed points*

DESIGNED for base load operation, first unit of the Sunbury, Pa., plant of Pennsylvania Power & Light Co. went into operation Aug. 1949 with the second following in Oct.

To get high load factor the turbines were altered to give highest efficiency at maximum load, and the steam conditions and heat balance were selected to give best heat rate. Boilers were designed for high efficiency when burning relatively low-grade fuel by making the furnace large and providing refractory-covered water-cooled furnace walls below the burner arches. Facilities for reburning the high-carbon dust, caught by mechanical separators, are built into the hopper bottom of each furnace.

Other features to assure high availability are:

1. Ample water-cooled surface within the furnace envelope reduces the temperature of dust in the gas leaving the furnace to a point well below its fusion temperature. This minimizes the possibility of molten ash depositing as slag on the furnace-wall and screen tubes or the superheater and convection surface of the boiler.

2. Low gas velocities through the boiler, superheater and economizer prevent cutting of the tubes by flue-gas dust.

3. Variable-speed drive of the induced-draft fans through magnetic couplings permits operating the fans at the lowest speed possible. Thus fan speed varies with load and blade erosion is kept at a minimum.

4. Mechanical and electrostatic dust separators in series reduce fan-blade erosion.

5. Complete water treatment, with evaporation, degasification, deaeration and chemical-feeding equipment minimize corrosion and scale.

6. Built-in connections for acid cleaning reduce steam-generator outage time.

7. Closed cooling-water system with a spare heat exchanger permits cleaning tubes without shutting down a main unit.

8. Recirculating system prevents formation of frazil or anchor ice on intake screens.

9. Auxiliary equipment for critical services is in duplicate.

Plant arrangement provides for stocking, conveying and bunkering prepared anthracite, unprepared anthracite silt or slush and bituminous coal. Ash content of the silt varies from 16 to 50%.

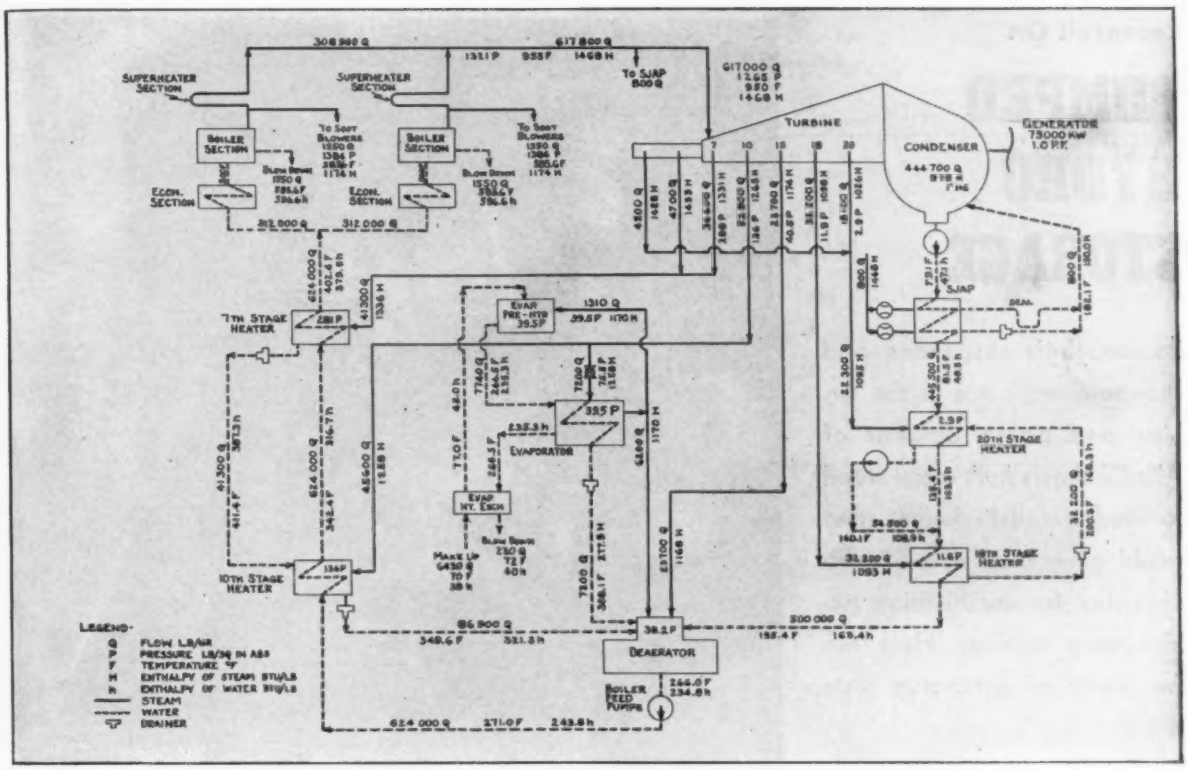
Bituminous coal serves to augment oil torches in lighting off a cold boiler, to mix with the anthracite as a drying agent and as an emergency fuel when anthracite is not available.

Previous operating experience with direct-fired pulverized-anthracite boilers was limited to a steam output of 175,000 lb per hr in industrial plants. The largest bin and feeder pulverized-anthracite fired boilers in existence, having continuous rated capacity of 340,000 lb per hr each, are those in the Company's Hauto Station.

A single boiler for each unit would have required a steam output of 750,000 lb per hr. This was deemed too great an increase in capacity above past experience to take in one step. Consequently, two 400,000 lb per hr boilers were selected for each of the two 75,000-kw turbine generators.

Boilers are direct fired and each has two ball-and-tube type pulverizers, of the largest capacity available. The three fuels are blended as required in the pulverizers. Because of the sticky nature of the small sizes of anthracite, coal-feed pipes are exceptionally large and the run from the bunkers to the feeders is nearly vertical.

Direct firing, in addition to lower cost than a bin-and-feeder system, simplifies operation and eliminates the dirtiness and operating cost of coal dryers. Since the anthracite contains up to 15% moisture, pre-heated air is delivered to the pulverizers at 600 F. The anthracite is ground to a fineness of not less than 85% through a 200-



HEAT BALANCE *for one unit carrying 75,000 kw load at 1.0 in. Hg back pressure*

mesh screen, with not less than 99% through a 50 mesh.

The furnaces are 38 ft 8 in. wide by 26 ft 5 in. front to rear and are fired from both sides with the burners pointing vertically downward through horizontal arches. Heat release is 8,520 Btu per cu ft per hr at a steaming rate of 400,000 lb per hr.

On leaving the furnace, the gas passes through a bank of screen tubes into the superheater, then through the extended surface boiler section and economizer. It then divides and passes through two regenerative air heaters. After leaving the last of these heat-recovery devices, each gas circuit passes through a mechanical multi-cyclone dust collector, followed by a double section electrostatic precipitator, and then to induced-draft fans of the steel plate erosion-resisting type.

Steam temperature is controlled by a condenser located in the superheater inlet header. After the feedwater passes through the regulating valve for the boiler, the flow divides between two paths as dictated by an automatic control responding to steam temperature.

One path leads through the economizer to the boiler drum, and the other passes through the tubes of the superheat-control condenser. The saturated steam passes through the space surrounding the tubes and is condensed in amounts required to maintain a constant temperature of 955 F at the superheater outlet header. Design steam pressure at the superheater outlet is 1,350 psig.

Dust collected in the multiple-cyclone dust separator and from pockets below the superheater can be returned to the surface of the ash bed in the furnace bottom for reburning. Clinker grinders break up any fused ash or clinker coming down from the furnace.

Ash feeders, located below the clinker grinders, can be operated to maintain 10 ft or more of ash in the furnace bottom. Air at pressures up to 10 psig is introduced under the ash and dust bed for reburning carbon in the dust.

Refuse from the ash hoppers below the furnace is sluiced hydraulically into the ash pit through an ash crusher. There are two such ash pits beneath the basement floor, one for each pair of boilers. Flue dust is conveyed by vacuum systems to the same ash pits. In the ash pits, the refuse and dust are mixed with water and the slurry is pumped through dual pipelines to the ash-disposal area south of the station.

Three steam-generating units have nearly sufficient capacity to carry full rated load on the two turbines. Crossovers permit the use of full steam-generator capacity for this purpose, whenever one of the four is out of service.

When Unit No. 3 is installed, the crossovers will permit using full capacity of the four anthracite-fired steam generators and will permit recapturing the spare steam capacity installed in Units 1 and 2.

The generators are the largest single-shaft units with which there had been reasonable operating experience at the time of placing the order. They are hydrogen-cooled, rated at 13.8 kv, 75,000 kva at 0.5-psig hydrogen pressure, or 86,250 kva at 15-psig hydrogen pressure. Designed for 0.9 short circuit ratio, they are single-winding wye connected, with neutral connected through a potential transformer to ground. This provides ground indication and limits the current to a value that will not burn the stator iron.

The grounding scheme provides alarm and indication only; there is no tripping automatically on ground indication. Lightning arresters and capacitors are installed on each phase of the generator leads for surge protection. The machine terminals are each provided with bushing-type current transformers for relaying and current indication, saving space in the lead runs below the machine. This is the first application of bushing-type current transformers to generator-lead bushings.

Research On

PUMPED HYDRO STORAGE

Pooling their resources and knowhow, engineers in the turbine and pump divisions of Allis-Chalmers built a test stand to study model designs that would give best over-all efficiencies for combination turbine-pump service. Here are the results of extensive tests

Playing host to forty engineers from public and private hydro-electric utilities, Allis-Chalmers' engineers revived interest in pumped storage for hydro-electric plants by explaining their research results on the subject. A brief outline of their work is described here and detailed information is available in the complete papers.

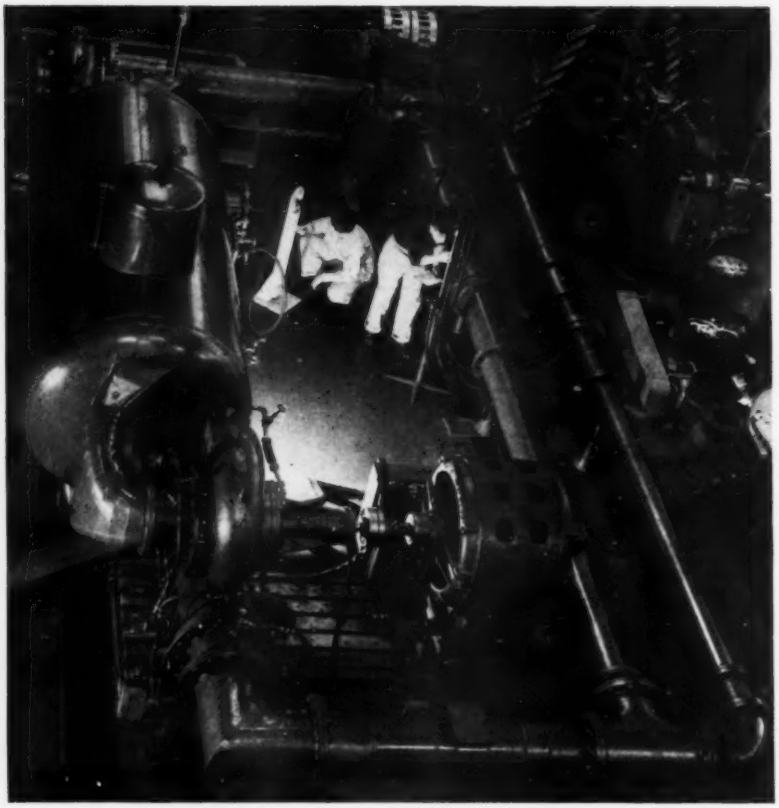


Fig. 1—The test loop includes two identical pump-turbine models, one being tested as a pump and the other as a turbine in the same hydraulic circuit

Pump-Turbine Design and Test, by W. W. Weltmer, Centrifugal Pump Dept.—Early experimenters found that a good pump running as a turbine under reverse rotation and flow had a creditable efficiency. This fact gave rise to the thought of using a single unit instead of a separate pump and turbine in pumped-storage hydro-electric power projects.

Such a unit requires more head and capacity at its best point of efficiency as a turbine than it develops at its best point of efficiency as a pump. But from the standpoint of head available from the external system, the reverse is true. For a given capacity, the pump must develop the static head plus friction, whereas the head available to it as a turbine is the static head minus the friction. Thus we are not able to utilize the maximum pump-turbine efficiencies of the unit with the same external system.

The introduction of variable guiding apparatus in the casing of the pump-turbine unit helps in our effort to make the characteristics of our pump-turbine fit those of the external system. To further improve this fit we studied the design of a compromise unit.

From an operations standpoint, the salient feature of such a design is that the reverse runaway speed of a compromise unit will be higher than that of a pump of equal specific speed. This comparison is made with the pump rather than the turbine, for the configuration of the compromise unit will be closer to that of a pump than it is to that of a turbine.

We have built and are testing two identical pump-turbine models, one running as a pump and the other as a turbine in the same circuit, Fig. 1. It consists of a suction nozzle, a medium specific-speed runner, adjustable guide vanes around the runner's periphery, fixed stay vanes outside of these, and a volute casing. Its specific speed as a pump at designed gate is 4230 on an rpm, gpm, foot-head basis, or if you prefer an rpm, cfs, foot-head basis, its specific speed is 199.5. Its specific speed as a turbine at the same gate is 51.8 on an rpm, hp, foot-head basis. We chose these specific speeds because of scarcity of the pump-turbine data available for them. This unit represents our notion of a fair compromise.

The pump-turbine characteristics, Fig. 2, are plotted on the basis of using the pump's capacity, head, and brake horsepower at the designed gate as the 100% values. It is interesting to notice how close the pump's and turbine's best points of efficiency are to each other from a capacity standpoint. This is one of the things we were seeking to do with the compromise unit. Head required by the turbine at a given gate, however, is still higher than that developed by the pump at the same gate. We must still rely on the gates to improve the fit between the pump-turbine unit and the external-system characteristics.

We have another means at our disposal to fit the pump-turbine characteristics to those of the external system. Since the basic proportionalities of Q varies as N, H varies as N^2, and hp varies as N^3 hold for turbine as well as pump, we can pump and generate at different speeds. The pump would run at a higher speed than the turbine. This would require the equivalent of a two-speed electrical machine.

In practice, if the unit is set to be safe for the pump from a cavitation standpoint, such a setting will be even safer for the turbine. We have, there-

(Continued on page 80)

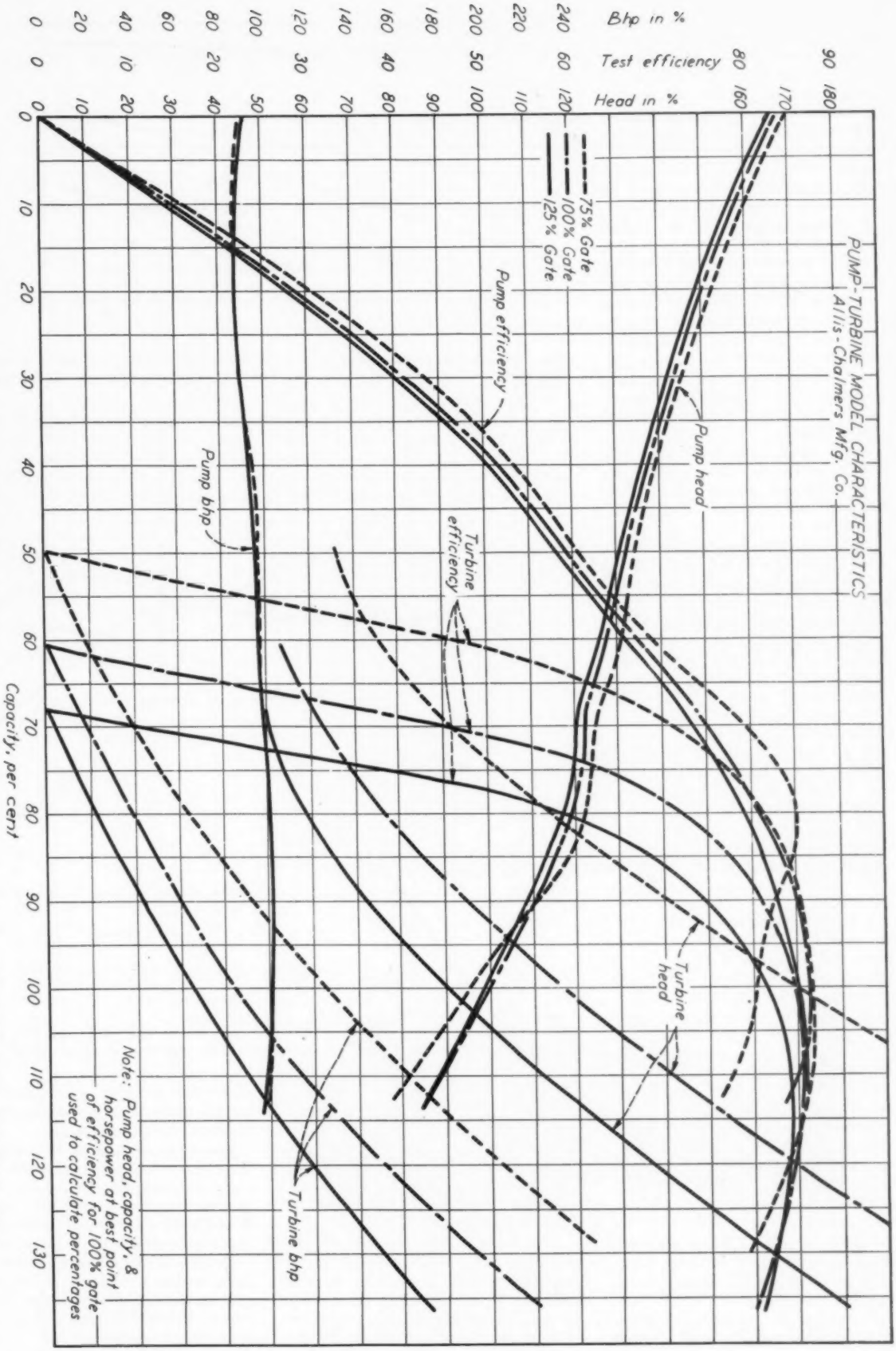


Fig. 2—Combined characteristics plotted on the basis of using the pump's capacity, head and brake horsepower at the designed gate as the 100% values

fore, run our tests with a net positive suction head safe for the pump.

Application of the Pump-Turbine, by F. E. Jaski, Hydraulic Turbine Department.—One of the functions of the pump turbine as a prime mover will be to supply additional horsepower capacity during peak load on a system. When pumping, the dynamic head consists of the static head between the elevation in the suction pool and storage reservoir plus the friction loss in the system.

When generating power, the net head on the turbine is the static head minus the friction loss in the system. We start generating power with the high head produced by a full storage reservoir and lowest level in the suction pool, and the head then drops gradually to the minimum as the storage pond is drawn down and suction pool is filled.

For a given static head when generating power, the runner may use more water per second than it will discharge when run as a pump. Advantage of the unit lies in using it in a fairly large power system, which can supply power for pumping during the off-peak period when the energy can be bought at a low cost.

For illustration, consider a unit required to supply an average of about 5000 kw at 163.6 rpm for 8 hr. Assume a static head of 90 ft between the full storage pond and the suction pool when it is drawn down to its lowest level.

If the friction loss on the system is about 3 ft, net head at the start will then be 87 ft, Fig. 3. Expected output at the beginning of the period will be 9450 hp or 6750 kw at 0.9 power factor and the discharge 1100 cfs. The expected turbine efficiency would be 87% and the generator efficiency about 96%.

Taking the static head at the end of the period, with storage pool drawn down and suction pool filled, as 60 ft and system friction head as 2 ft, the minimum net head is 58 ft.

At the end of the power period the unit will generate 3450 kw and discharge 910 cfs. Thus during the 8-hr period the output will gradually vary from 6750 to 3450 kw and will generate a total of 40,800 kw hr.

The amount of water used during the 8 hr period will vary from 1100 to 910 cfs, about 1000 cu ft per second, or 3,600,000 cu ft per hr. For an 8-hr period this would require 660 acre feet of water.

During the pumping cycle the pump starts against a static head of 60 ft. With a friction loss of 3 ft the dynamic head is 63 ft, Fig. 4.

At the end of the pumping period the static head will be 90 ft. Assuming the friction loss is 2 ft the dynamic head will be 92 ft. The discharge against 63-ft head will be 1150 cfs and at 92 ft 730 cfs. The average discharge pumped will be about 940 cfs, or 3,380,000 cu ft per hr. The pumping period would have to be 3.6/3.38 times 8 or 8.53 hr.

The average power required for pumping, will be about 9700 brake horsepower. During 8.53 hr we will consume 82,700 hp hr or 63,600 kw hr at 1.0 power factor. The motor efficiency is assumed as 96%. If the power for pumping costs 4 mills per kw hr, total cost for pumping will be approximately $254.40.

Assuming the generated power can be sold for 1.25 cents per kw hr during peak load, the 40,800 kw hr of generated power will be worth $510.00, or the ratio of return from generated power will be about 200%.

Results of these studies show that pump turbines can be built for heads comparable to those under which Francis turbines are used today—50 to 1000 ft.

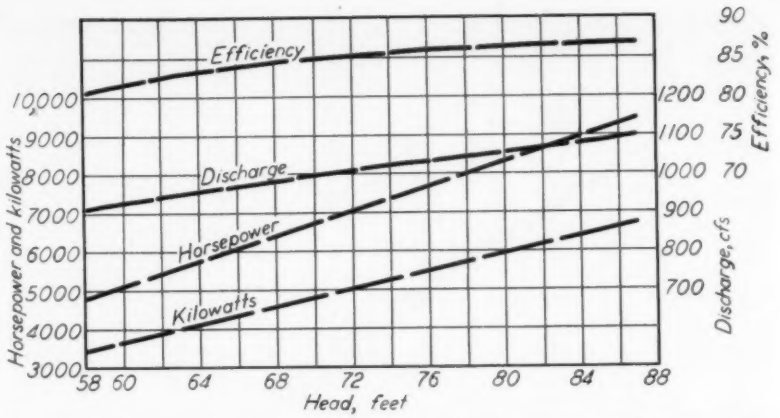


Fig. 3—Expected performance curves for the pump-turbine unit while generating electrical power from an initial net head of 87 ft to final net head of 60 ft

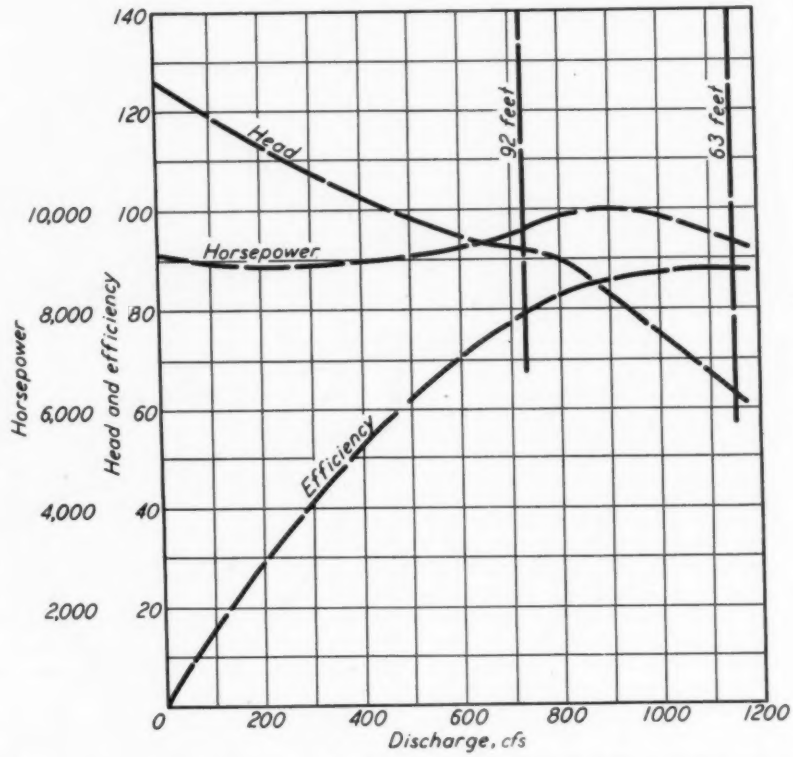


Fig. 4—Expected performance curves for pump-turbine unit while pumping water from an initial dynamic head of 63 ft to a final dynamic head of about 90 ft

Solutions to Your Problems in . . . .

. . . . FEEDWATER TREATMENT

DR. R. C. ULMER, *Technical Director, Power Chemicals Div., E. F. Drew & Co. Inc.*

In the June issue we discussed methods of treatment that would correct troubles in the feedwater and boiler sections of the plant water cycle. This concluding part tells how to prevent carryover deposits and cure return-line corrosion

PROBLEMS ENCOUNTERED in steam and condensate lines may be divided into those originating from (1) deposits and (2) corrosion. Deposits are confined mostly to superheaters and turbines although they may occur in process equipment. Corrosion is usually of two general types, (1) high-temperature corrosion between the metal and steam by direct reaction and (2) corrosion on the metal as the steam condenses, and from the condensate itself. The second type may cause plugging of pipes.

Superheaters. Deposits in superheaters have become more and more a problem since steam temperatures have increased. Any slight overheating, as the result of a deposit, may cause the metal to reach its creep temperature and rupture. Also at temperatures above 900 F there is appreciable reaction between the steam and metal and, in time, the wall will be thinned considerably.

For these reasons the trend is toward alloy tubing having high creep resistance and great resistance to oxidation. Sometimes the tubes are made of two alloys, low carbon steel being used for the inlet end and alloy steel for the outlet end. During the oxidation reaction, hydrogen is given off and tests made on the steam for hydrogen will show whether this type of corrosion is occurring.

The rather complicated design of superheaters provides little opportunity to remove deposits mechanically, and chemical cleaning has been employed to some extent. As the deposits are due chiefly to evaporation of water carried over from the boiler, the emphasis on corrective measures should be placed on the elimination of carryover. Such measures were discussed in the June article.

Turbines. Non-silicious deposits are caused chiefly by boiler-water salts carried over with the steam. Silicious deposits may be caused by this same mechanism and also by volatilization of silica from the boiler with the steam. In the latter case, the silica condenses on the metal parts as the steam is cooled. As for deposits from carryover, corrective measures again are eliminating or decreasing the carryover as discussed in June. With volatilization of silica, the most practical way to prevent it at high pressures is to limit the silica content by external treatment. At low pressures, maintaining the proper alkalinity (above pH 10.5) will prevent volatilization.

Some work has been done in pre-

Fig. 1—Pitting and building up of tubercles on pipe walls, usually attributed to oxygen corrosion, increases pipe friction, chokes flow

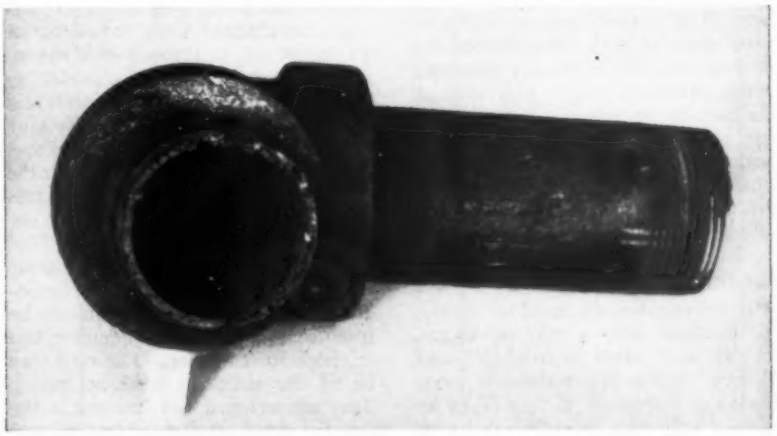


Fig. 2—Channeling, or washing away of the metal, usually attributed to carbon dioxide, appears on the pipe surface contacted by condensate

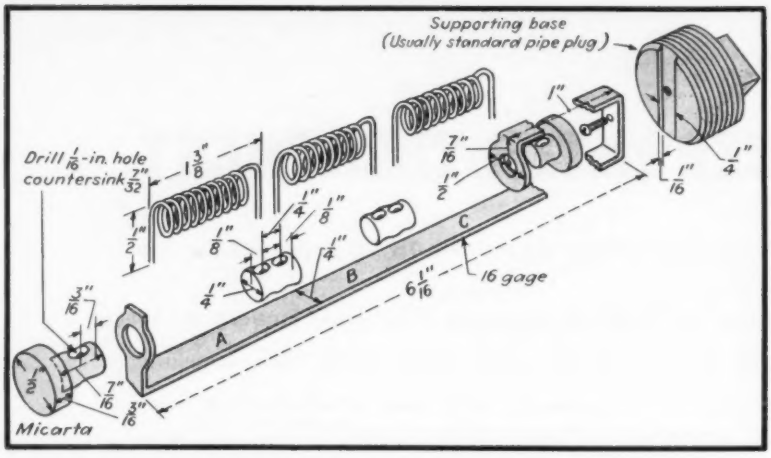


Fig. 3—Test device consists of several spiral coils of the same or different metals supported on a frame and inserted in the pipeline

venting volatilization of silica by precipitating it inside the boiler. Magnesium is added directly to the boiler. Chloride salts are commonly used. The silica can be reduced readily to 1 or 2 ppm, at which concentration there is no appreciable volatilization. Only a low phosphate concentration can be carried in the boiler, a maximum of about 5 ppm being permissible. There has been no trouble from magnesium or silica deposits in the boiler with proper use of organics.

Chemical analyses of the deposits vary throughout the turbine as the steam temperature changes. At the high-temperature end, the deposits are quite water soluble, consisting of boiler-water salts — alkalis, chlorides, sulfate, phosphates, etc. At the low-temperature end, where condensation usually takes place, little if any water-soluble material is present and the deposits usually are very high in silica. Between these extremes they consist of combinations of salts and silica.

At the high-temperature end, caustic soda often causes the deposits to adhere. The material remains sticky or pasty even at high temperatures and in this condition causes dry materials, which otherwise might pass through the turbine, to adhere. Some success has been attained in preventing deposits by adjusting boiler-water constituents so there always is sufficient dry material, such as chloride or sulfate, present to coat the "sticky" caustic particles before the steam reaches the turbine.

If turbine deposits build up slowly, for example, over a year or longer, they are quite often removed by "sand blasting" when the turbine is overhauled or inspected. If they build up more rapidly they generally can be removed by "washing".

Since a considerable part of the deposit, especially in the high-temperature end (the critical section), is water soluble, great improvement can often be obtained by "water washing" alone. Removing silica usually requires washing with alkali solution at high temperatures.

Condensate Lines. Corrosion of return lines leads to failure of equipment, but just as important in many cases is the plugging of lines by corrosion products. Failure of equipment usually occurs as pitting, Fig. 1, or as furrowing or channeling, Fig. 2. The latter usually shows up first at the threaded portion where pipe wall is thinnest.

Chief causes of these types of failure are dissolved oxygen and low pH as a result of the presence of carbon dioxide. If pitting is present, dissolved oxygen usually is the controlling factor, whereas if furrowing or channeling is present, low pH is likely the controlling factor. Failure may occur as a combination of the two types of corrosion just mentioned.

In the past there has been considerable speculation regarding the role of carbon dioxide in such corrosion. Recent experimental work shows that at pH below 5.6, an aqueous solution containing carbon dioxide corrodes in much the same manner as a mineral acid having the same pH. In relatively pure water such as condensate, only about 2 ppm of CO_2 is necessary to lower the pH to 5.6, so it is obvious why this type of corrosion is so commonly encountered.

Testing for Corrosion. A simple tester, Fig. 3, developed by the National District Heating Association, can be installed in a steam or condensate line to check for corrosion. The coils may be of the same or different metals. They are weighed and inserted in the line for about 30 days. After the test the coils are cleaned, reweighed and the loss in weight calculated.

Tests for pH and free CO_2 can also be conducted on samples of the condensate to determine its corrosiveness. Corrosion is likely to occur if the pH is below 7.0 and if there is more than a trace of free CO_2 present.

Preventive Measures. Alloys can, of course, be used to prevent failure, but treatment to eliminate the cause of corrosion usually is more practical. Proper design and venting of equipment is very important. Inleakage of air should be avoided.

Concentration of carbon dioxide and dissolved oxygen in the steam must be kept at a minimum. Removing dissolved oxygen involves proper deaeration and, in many cases, adding an oxygen scavenger to the boiler water. In the case of carbon dioxide, proper external treatment with lime or acid will greatly reduce the carbon dioxide. Elimination of carbonates such as soda ash in internal boiler-water treatment also will appreciably reduce the carbon dioxide in the steam.

Regardless of the corrective measures just mentioned, it usually will be found that the condensate pH is so low that some degree of corrosion will take place. Low pH is the usual cause. Consequently treatment with amines, ammonium organics, etc. to raise the pH is desirable.

For example, when an ammonium organic is added to the boiler, ammonia is slowly liberated and passes off with the steam. The ammonia neutralizes acidic substances—carbon dioxide, etc. —and raises the pH to a value where no corrosion takes place. The material can be introduced into the boiler, the steam, or any part of the system.

Ammonia

There has always been apprehension in this country over the presence of ammonia in steam and condensate. Some of this has been caused by the fact that free ammonia was used without proper control. Consequently, the pH became too high and corrosion of copper and zinc alloys occurred. Use of an organic ammonium product overcomes this difficulty, and excellent results have been obtained in preventing corrosion.

Data has also recently been obtained, especially from Germany, which show satisfactory use of ammonium compounds for corrosion control in steam condensate systems. These data indicate satisfactory results without corrosion of copper and zinc alloys, provided the pH is kept within set limits.

With respect to corrosion of copper- and zinc-alloy parts by steam and condensate containing ammonia, the writer was associated for years with a company operating a plant at 900 psi. No trouble was encountered even though

the condensate had a pH of 8.5 to 9.0 most of the time because ammonia-contaminated water was used in the evaporators.

This plant had the usual copper-alloy condenser-heater system and feedwater temperatures were as high as 400 F. The water pH was quite constant, that is, it never reached a high value even for short periods. Experience shows that if a high pH is avoided, ammonia-organic compounds can produce satisfactory results in preventing condensate-line corrosion.

Summarizing boiler-water-conditioning practice, the field may be divided into two classes: (1) those involving large amounts of condensate, for example utilities, and (2) those requiring considerable makeup. In the first case, with increased pressures, the trend has been toward more complete removal of feedwater impurities by using evaporators or anion-cation exchangers. Some industrial plants operating above 900 psi have not followed this trend.

With these methods of treatment, impurities in the boiler water are limited to (1) chemicals added as treatment (2) carryover from evaporators and (3) condenser leakage. Treatment usually is at a minimum, and limited to the maintenance of a low alkalinity, often due only to captive alkalinity; a low excess of phosphate and in some cases sulfite. There normally is little if any sludge problem since feedwater hardness is low.

In the second case the trend has been toward removing most of the hardness outside the boiler, especially for high-pressure operation. Even so, considerable internal treatment is required. General practice is to maintain a rather high alkalinity (about 50 to 200 ppm of hydrate), an excess of phosphate (20 to 50 ppm as PO_4) and in some cases sulfite. Because some hardness remains in the feedwater any appreciable amount of makeup introduces a sludge problem. Conditioning the boiler water with an organic colloid has been found advantageous.

Alignment Chart Helps Solve Sweating Problem

• ALIGNMENT CHART at the right eliminates guesswork and equations, to show directly the minimum insulation thickness that prevents surface condensation according to the equation:

$$\left(\frac{1}{\frac{x}{k} + \frac{1}{f_o}} \right) (T - T_2) = f_o (T - T_2)$$

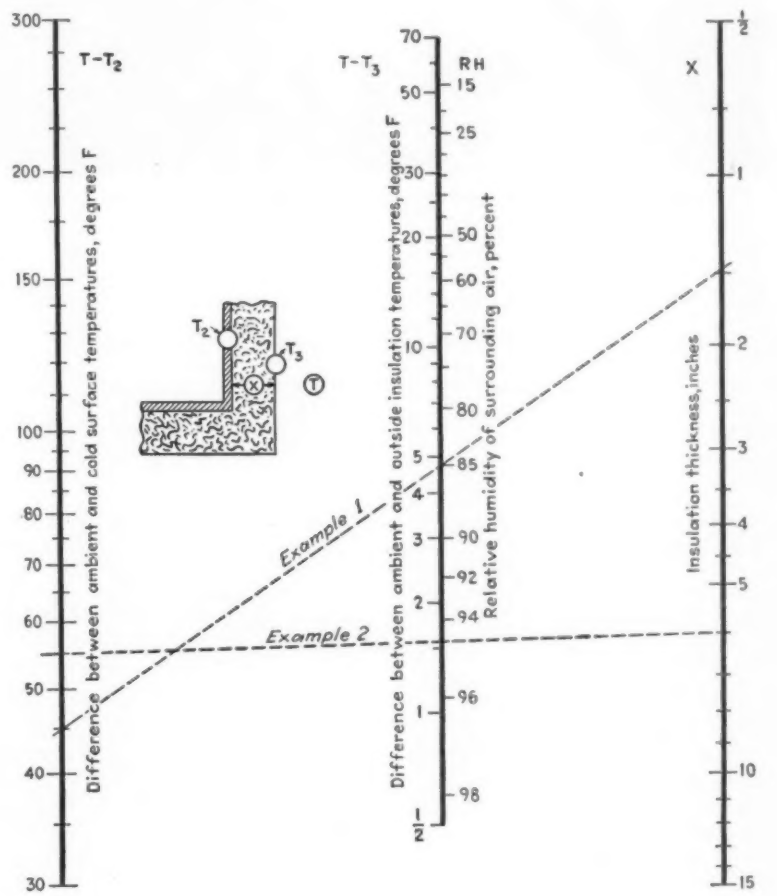
f_o=coefficient of heat transfer between outside insulation surface and still air—1.65 Btu per hr per sq ft per deg F (Marks' Mechanical Engineers' Handbook, 4th edition pp. 1638-9).

k=thermal conductivity of insulation—0.29 Btu per hr per sq ft per deg F. per in.

The temperature (T_2) of the cold material in the pipe or vessel, the relative humidity (RH) and the temperature (T) of the surrounding air are the conditions at each particular cold surface that determine the minimum insulation thickness. Because it more than covers the practical ranges of temperature and humidity, the chart (based on k=0.29, an average thermal conductivity for mineral-wool insulation) is applicable to any cold surface.

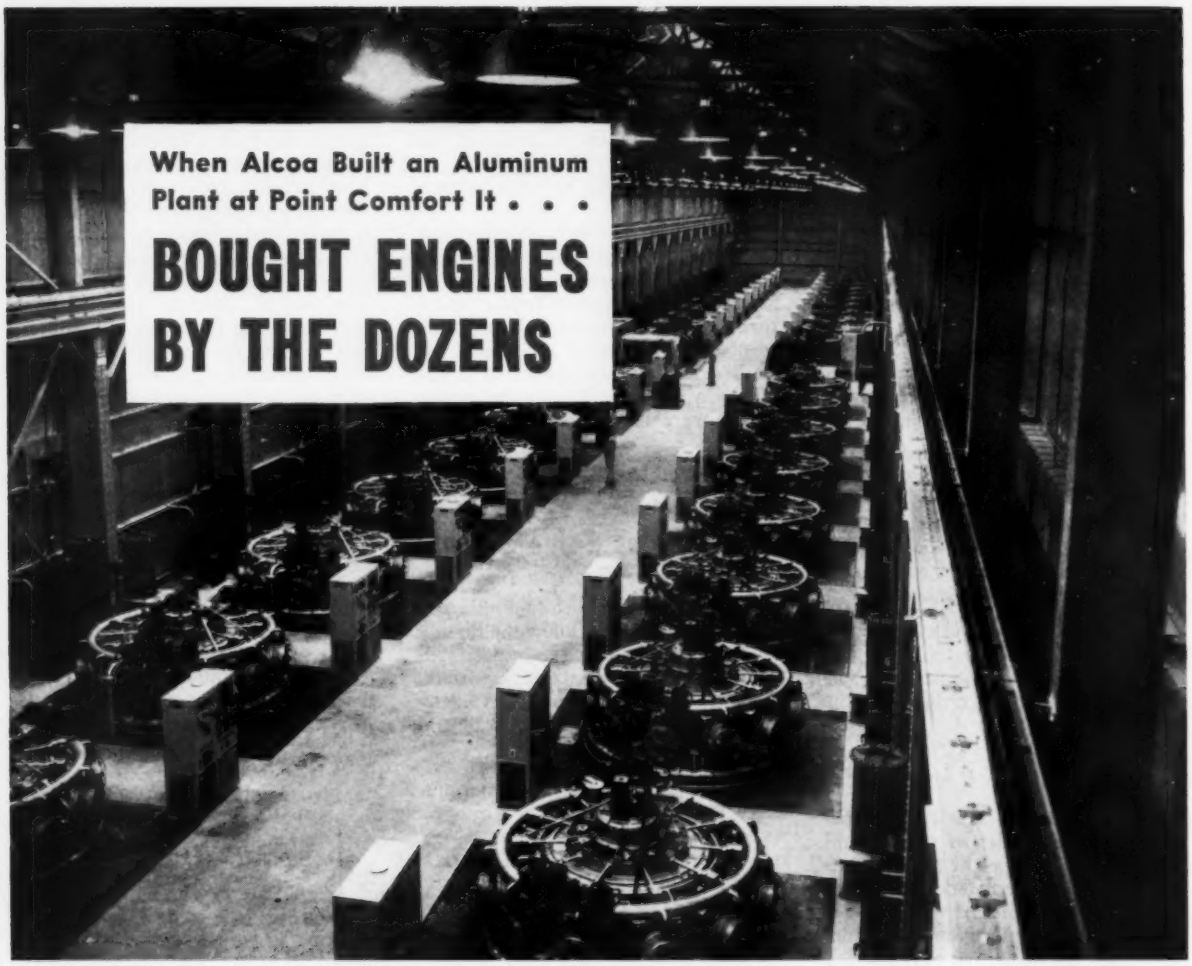
Two examples illustrate how to use the alignment chart: (1) A sheet-metal duct carries cool air at 48 F through a basement where the ambient temperature often reaches 93 F and the humidity rises as high as 85%. Find minimum insulation thickness. Then $T\text{-}T_2$ (93-48 is 45 and RH equals 85%. A straight line drawn through 45 on the left-hand scale ($T\text{-}T_2$) and 85 on the center scale (RH) is found to intersect the right-hand or x-scale at 1½ in.—the minimum insulation thickness necessary.

(2) A tank containing brine at 27 F (T_2) is to be covered with a 6 in. thick blanket insulation. Maximum temperature of the surrounding air is 82 F, but we want to know the highest relative humidity that can be tolerated without sweating on the tank surface. Draw a straight line through 55 (82-27) on the left-hand ($T\text{-}T_2$) scale and 6 (blanket thickness) on the right-hand scale. The line crosses center (RH) scale at about 94½%, the highest relative humidity that will not cause sweating. *Courtesy of the Industrial Mineral Wool Institute.*



When Alcoa Built an Aluminum Plant at Point Comfort It . . .

BOUGHT ENGINES BY THE DOZENS



THREE *powerhouses contain forty engines each. Generators are in engine bases, and auxiliary equipment below*

Each of three powerhouse buildings contains a battery of forty 1600-hp radial, dual-fuel diesel generating units. Designed for either oil or gas operation, the engines now run on natural gas from the Texas oil fields and supply power to aluminum pots

ALCOA's Point Comfort Works, located near Port Lavaca, Texas, is spread over 3,000 acres and consists of 25 buildings. Three of the buildings house the engines needed to generate electrical power for aluminum production. Each building contains 40 vertical internal-combustion radial engines directly connected to 1,000-kw generators. Present operation is with natural gas from the Texas gas field, one engine-generator unit serving each pot line. Nominal generating capacity of the power plant is 120,000 kw. Under normal operating conditions, total output of the plant is approximately 2,750,000 kw-hr per work day.

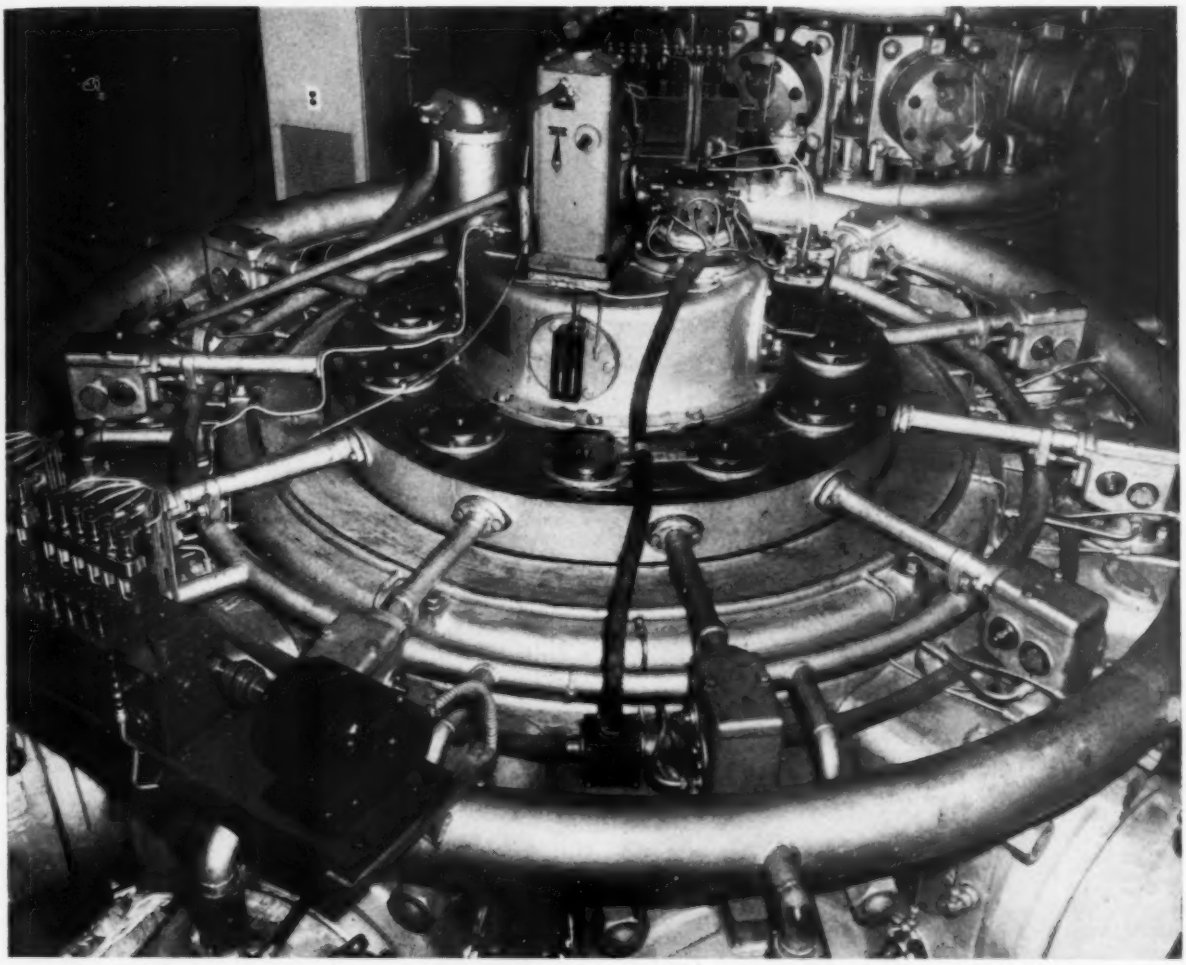
Engines are two-cycle, radial-type built by Nordberg Mfg. Co. with slight modifications. They can be adapted to gas, diesel fuel or dual fuel operation. Each engine has eleven 14 x 16-in. cylinders and operates at 360 rpm with a shaft output of 1600 hp. Thermal efficiency is about 29 to 30%.

Crankshaft of each unit is set vertically and cylinders are bolted radially to a cast frame. A central hub carries both the lower main-bearing bushing and thrust bearing, which supports shaft load. A heavy, bolted cover contains the upper main bearing bushing. Governor, fuel pumps, mechanisms for gas operation and controls are located on this cover. Circular manifolds for scavenging air and exhaust are at the lower level of the engine room. Intake and exhaust are timed by the pistons uncovering ports in the cylinder walls, and no valves are required.

Balanced operation is accomplished by using a master gear, a stationary gear bolted to the cover, two pinions and rotating counterweights. Connecting rods are attached to the master gear through knuckle pins mounted in bronze bearings. Master gear gyrates instead of rotating. The master connecting rod, commonly associated with radial-type engines, has been omitted in the design of this unit.

Lubricating Systems

Two systems of lubrication are employed. Motor driven, multi-feed lubricators deliver oil to each cylinder for piston lubrication. A circulating pressure system provides oil for all



RADIAL ***diesels operate on gas, oil or dual fuel. Governor, distributor, lubricator and gas valves are visible***

other parts requiring lubrication and for piston cooling.

When set up for burning gas, the engines operate on reduced compression with spark ignition. Fuel is admitted by cage mounted gas valves. The valves are operated by a cam on the crankshaft and are located so gas is admitted into the path of incoming scavenging air. This assures thorough mixing and efficient use of the fuel. A valve inserted in the gas line and controlled by a governor, varies the amount of gas delivered to the cylinders according to engine load.

Natural Gas Pressure

Natural gas is delivered to the plant at 400 to 500 psi. This pressure is reduced in two stages to 60 psi. Two 8-in. gas lines connect each of the three power houses with the pressure-reducing station. A regulator at each engine further reduces the intake pressure, and in actual operation, gas enters the engine at about 6 psi.

Each engine consumes about 13,000 cu ft per hr under load. Normally, the plant will use more than 30,000,000 cu ft of gas a day.

Electric generators—supplied by Elliott Co., General Electric and Westinghouse—are located in the lower level of the powerhouses and are direct connected to the engines. Each engine-generator unit, with its auxiliaries, operates independently and produces 1000 kw (d-c) at 667 v and 125 kva (a-c) at 425 v and 24 cycles. The a-c power is used for driving the engine auxiliaries. This eliminates the need for a common auxiliary power system and possibility of a total station interruption. In addition, the generator is used as a motor in starting the engine.

Each unit has its own control panel including engine protective equipment, which shuts the engine down automatically on low oil pressure, high water temperature, high exhaust temperature, over-speed, high generator temperature, or auxiliary power loss.

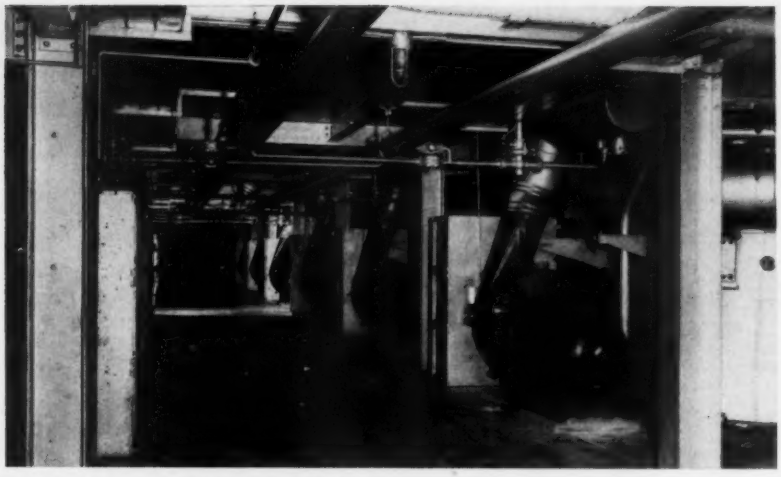
In addition to unit control panels, each powerhouse has a master control room with recording and indicating equipment to record and supervise the operation of the 40 engines and generators. Units cannot be started or stopped from this master control room, but it acts as a central point from which plant operation can be observed.

Centrifugal-type scavenger air blowers, which provide 7,000 cfm of air under pressure to the engine cylinders, are driven by 100-hp motors.

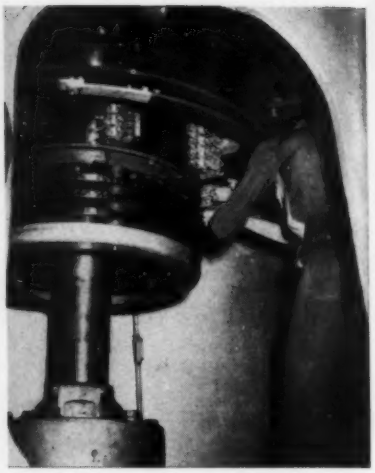
Axial-flow type, generator-cooling fans are driven by 7½ hp motors. The fan supplies air at the rate of 12,000 cfm. Along the wall, behind the generators, are the high-speed switchgear, generator control and starting devices.

Combination oil-and-water coolers for the system—built by Trane Co.—are approximately 15 x 11½ x 3 ft. The exchangers are all-aluminum except for cast-iron headers. Alclad aluminum alloy 3S is used for both tubing and fin stock. Tubes are arranged in banks of three with the water tubes in front of the oil tubes.

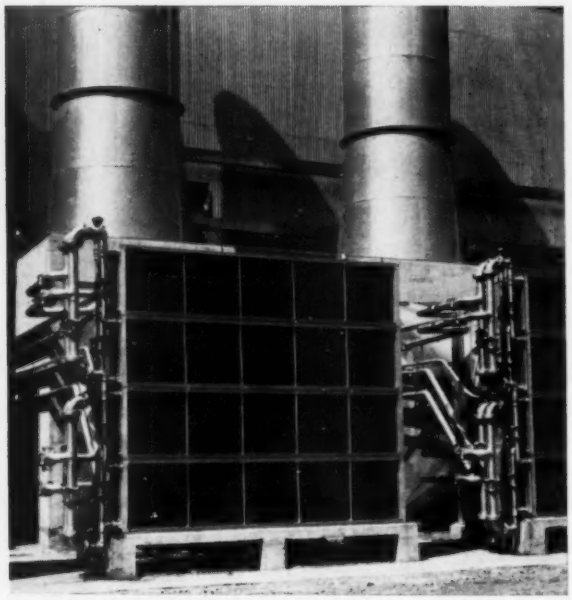
Tubes and vertical fins are joined



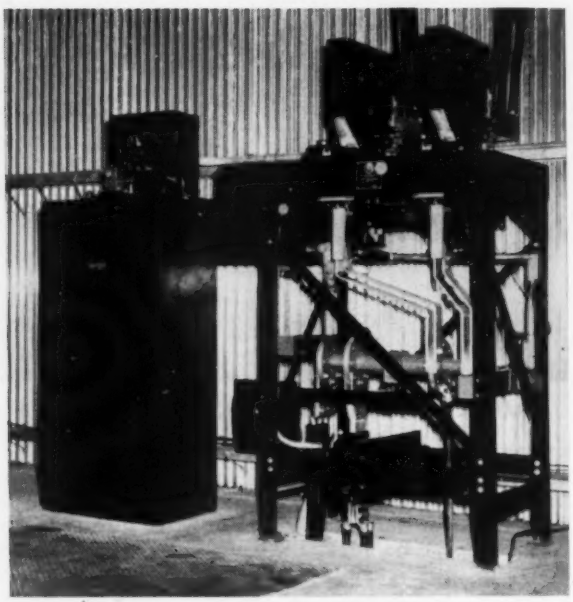
BLOWERS, *for supplying 7000 cfm of scavenger air under pressure to the engine cylinders, are mounted next to the engine bases on the powerhouse lower floor*



GENERATORS *supply 1000 kw, 667 v dc with 25-cycle power for auxiliaries*



HEAT *exchangers cool engine water and lubricating oil, are 15 x 11½ x 3 ft and all aluminum except for headers*



CONTROL *panels for each generator include engine protective equipment. Each powerhouse has master control room*

mechanically. Exchangers consist of four sections, which are independent of one another except for connection to a common manifold. Individual tubes may be cleaned or cut out without interfering with exchanger operation.

An 84 in. heat-exchanger fan, having six adjustable blades, is driven by a 2-speed, 25-hp motor. Oil and water circulating pumps are driven by a common 15-hp motor.

Each engine room has 40 air-washing units with 14 x 5 x 5-ft housings. Individual units, containing thirty all-aluminum washer cells, have an air capacity of 35,000 cfm. Water is sprayed at a rate of 125 gpm.

Sixty-cycle, 4000-v a-c is produced by four 667 d-c motor generator sets. This power is for general works use. There is also a 250-v, 250-kw generator on each set to provide crane power.

Engine Exhaust Stacks

Engine-generator units have their own stacks, which handle engine exhaust, generator cooling air, and the air from their heat exchanger. The stacks, each one 7½ ft in dia and 50 ft high are made from 1/8 in. aluminum sheet. The all-riveted stacks were fabricated on the job.

Practically all electrical conductor in the plant is aluminum. Approximately 5½ million lb of aluminum bus conductor was installed. The bus is arranged in three 5,000-ft circuits, each including one powerhouse and one pot line. Bus joints were made largely by the inert-gas shielded-arc method of welding, and a complete welding shop was set up on the site for this purpose. The main bus consists of 22 aluminum bars having a cross section of ¾ x 10 in.

Aluminum wire, cable and conduit were also used extensively. Because of their resistance to atmospheric corrosion, aluminum towers and substations were installed for the 4,000-v, auxiliary power-distribution system.

When the river overflows its banks, this plant can continue supplying power to oil-well pumps up to the point of maximum flood stage encountered to date in that area

A POWER HOUSE ON "STILTS"

LOCATING A POWER PLANT to provide current for the motors on pumping wells in an oil field situated in a river bottom subjected to seasonal floods, presented a serious problem to the engineers. The plant could be set on high ground, and a long transmission line erected, or it could be built in the field to keep transmission cost and line losses to a minimum. The latter method was adopted, although it was necessary to provide protection against maximum flood level of about eight feet.

To get above flood level, the building was set on heavy pipe posts embedded in concrete, and welded into a strong foundation. The plant floor was 7½ ft above ground with the engine base 15 in. higher. A galvanized tank, mounted at one side of the building, catches water from one side of the roof and supplies it to the engine cooling system through a flow line above flood stage.

Fresh air for engine intake and radiator cooling, when weather conditions make it necessary to close doors and windows, comes through a draft pipe carried from an opening in the roof, directly in front of the radiator, to a point at the top of the cooling unit. A ball-bearing elbow at the top of the draft pipe allows it to swivel away from the wind, and thus avoid direct entrance of rain.

A second ventilator with drift vane, at the farther end of the building, discharges heated air from within the building. Connections to the two power-distribution pole lines are carried up to the roof line of the building and then to the nearest pole.

To prevent the possibility of picking up water in the ventilating inlets of the generator housing, the openings were reversed from their usual downward-pointing position so they are near the top of the generator case. This made the generator water tight to a point well above the shaft bottom. Duct openings were covered with ¼-in. hardware cloth to prevent entrance of foreign objects. This was demonstrated as a necessity after a forced shutdown had to be made to remove bodies of several birds from the generator air passages.

On several occasions the plant continued to operate when the water stood a foot deep over the station floor, and when the one-man crews came and went in boats, which were tied above the stair landing.—*ELTON STERRETT*

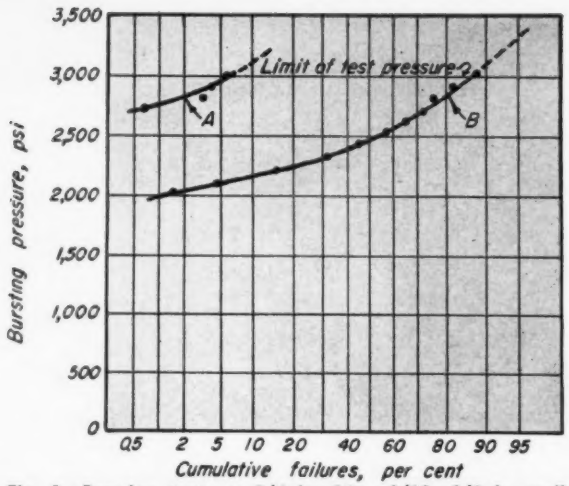


Fig. 1—Bursting tests on 3/4 in. OD x 3/32—1/8 in. wall tube, 18 in. long, show effects of manufacturing controls. A—high pressure glass, B—other glass of same composition

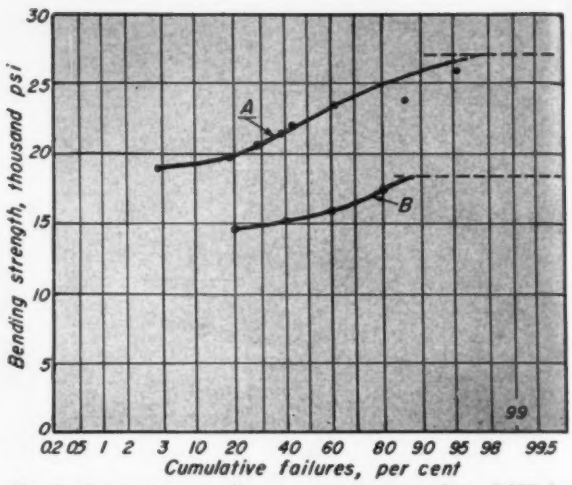


Fig. 2—Beam tests on flat, tempered gage glass, 1.327 in. wide x .672 in. thick, indicate clamp effects from mount. A—glasses as manufactured; B—after hydrostatic testing

GAGE GLASSES . . . .

. . . . Their Composition and Selection

EARL B. SHAND

Staff Sales Engineer
Corning Glass Works

This data, from laboratory tests and actual field observations, will aid the plant and powerhouse engineers to better understand the principles behind the proper selection and care of gage glasses for a variety of applications. Composition, tempering and durability of gage glasses affect their efficiency

FOR MANY YEARS there has been a steady increase in the severity of the requirements placed on direct reading liquid-level gages. Not only have the operating pressures of steam boilers been increased but, in addition, there has been a much wider use of such gages for still higher pressures at normal temperatures.

These trends have placed new burdens on the glass components of such gages, which in some cases have necessitated the introduction of new glass compositions. They have also made it essential that technical factors involved in the application of glass to such jobs be more widely understood.

Other than indicating liquid level, gage glasses must be able to resist: (a) mechanical stresses, (b) effects of high temperatures and (c) corrosive action of liquids and vapors.

Mechanical Stresses

Glass is defined technically as a "brittle" material. In this strict sense the term has no reference to material strength. This means, that unlike most metals, fracture occurs within the range of elastic deformation without plastic flow or yield. As a consequence, while glass is strong in compression, it may fail under relatively-low tensile stresses as compared with structural metals. It does not fail in shear, as is commonly the case for ductile materials.

Because there is no local yielding at points of high stress concentration, brittle bodies have a high degree of notch sensitivity, which is reflected in test values of strength. This applies not only to factors of design, such as radii of fillets, but also to various types of imperfections common to glass.

Imperfections in glass range from bruises, scratches and incipient cracks —resulting from manufacture, handling or misuse of the articles—to those submicroscopic in magnitude that are more or less inherent in the material and exist even on polished surfaces.

The larger and more serious flaws are accidental in their origin, and this results in non-uniform strength. If a series of glass specimens were tested under mechanical loading, the values of breaking stress obtained might vary considerably—sometimes over a range of 2 to 1.

Strength test on a single or several specimens of glass taken from a large group of articles will give only a limited amount of information regarding the strength values to be expected. In making control tests, adequate sampling must be done to ensure significant results for accurate data.

Fig. 1 shows control-test results that consisted of measurements of hydrostatic bursting pressure for: (A) 3/4-in. high-pressure tubular gage glasses and (B) tubing drawn to the same dimensional tolerances, but with lower restriction on quality. The curves show the cumulative percentage of failures versus pressure.

High-Pressure Glass

In the case of the high-pressure gage glass tubing, only 6% of the sample failed at the maximum test pressure of 3000 psi. At this same pressure, 88% of the other tubing failed, so that the characteristic distribution of breaking pressures for the *B* glass is clearly indicated.

The quality level of tubular gage glass has gradually improved from approximately that represented by curve *B* to that of curve *A* during the past

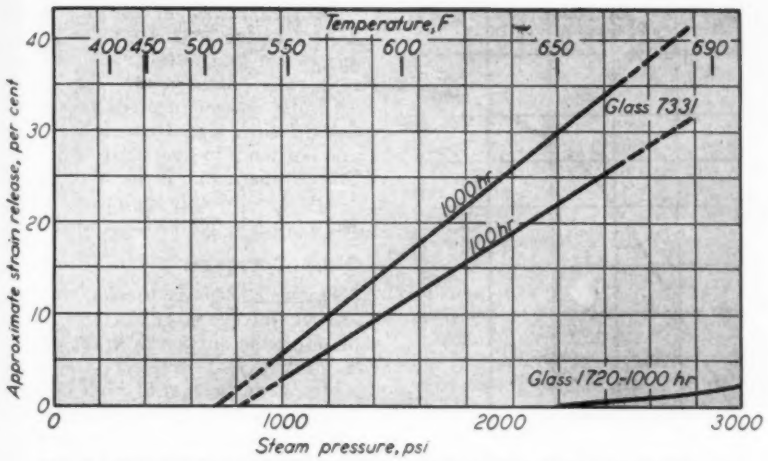


Fig. 3—Stress release from heat in tempered, flat boiler gage glasses reduces benefits of tempering. Higher pressures require improved glass

fifteen years. This result has been brought about by improved production techniques and closer process control.

While the lowest bursting pressure recorded for the glass tubing is 2700 psi, the maximum working pressure recommended in Table 1 is 600 psi. Only a part of this difference can be accepted as a factor-of-safety. Stresses required to fracture glass under loads of long duration are materially less than under short-time loads—the condition under which these tests were run in this investigation.

The "stress-time" curve for glass under static loading is generally similar to the fatigue curves of metals taken under conditions of cyclic loading. However, there is little difference in the strength of glass under static and clic loading providing the over-all duration is the same.

The "endurance limit" for annealed glass may be only ⅓ to ½ the short-time breaking strength, as represented by an effective duration of perhaps 1 to 5 seconds. This characteristic must be taken into consideration when applying glass components for any structural purpose.

Tempering

Fortunately, there is a method whereby the "endurance limit" may be raised greatly. This is by a heat treatment of the glass known as "tempering", and it consists of raising the glass to a high temperature and then chilling. Residual stresses are set up that are tensile in the interior and compressive at the surface, where failure in tension orginates in the vast majority of cases.

Tempering not only increases the short-time strength of glass, by a factor of 2 or 3, but it also raises the ratio between the "endurance limit" and short-time strength. This double effect increases the useful strength over that of annealed glass. Furthermore, tempering tends to reduce the harmful effects of surface bruises and scratches. The process is, however, subject to certain limitations such as may result from the geometrical shape of the piece.

Tubular gage glasses are not readily adaptable to this process. Very close process control is necessary to maintain the magnitude and the proper distribution of residual stresses in each piece of the glasses tempered.

Flat Gage Glasses

In the case of flat gage glasses, practically all of which are tempered, an additional advantage comes from the interlocking type of fracture. Fragments are held in place in the event of steam boiler gage glass breakage, and the escape of large volumes of steam is prevented.

Strength data for "high pressure" flat gage glasses are shown in Fig. 2. The tests were made on the glasses loaded as a beam in bending, because of the difficulty in determining the stress conditions when the glass is actually mounted in a gage.

Bending stresses, thus tested, are more representative of those caused by a temperature difference across the glass section. Curve A represents breaking stress values on glasses ready for shipment. Curve B represents bending tests on five similar specimens, which had previously been tested in a gage under hydrostatic pressure. The curves indicate that the procedure of mounting the glass in the gage and clamping it at very high pressures results in some degree of surface injury to the glass.

Strength of glass, as measured at room temperature, is a satisfactory indication of its strength over wide ranges of temperature both high and low. But consideration must be given to the fact that temperature gradients will produce additional stresses in glass that may combine with those resulting from mechanical loading. Consequently, gage glasses may be expected to withstand higher pressures at moderate temperatures than in high temperature service.

Data Factors

Although the glass manufacturer can recommend maximum working pressures for his products in specific types of service, as are shown in Table 1, such data must be based on certain average conditions. Actually, facts indicate the specific metal structure utilized has a very definite effect on the pressure that may cause the glass to fail. For tubular gages, the type and design details of the metal gage parts may influence the bursting pressure of the glass.

Instances have been found where pressure tests in one gage will give values consistently 40% lower than for another gage. For flat gage glasses this effect is materially greater, possibly from a maximum of 100% to a minimum of 25%. Factors involved include the deflection of metal parts under pressure, accuracy of the finish fit of metal surfaces to which the glasses are clamped, clamping pressures exerted on the glass and method of applying this pressure, and the type of gasket employed to seal the gage.

These factors may modify the breaking pressure over a range higher than 2 to 1. Other design details, such as the width of slot in the gage and cover flange, may produce an additional range of possibly 2 to 1. None of these factors is under the control of the maker of the glass components of the gages.

Temperature Effects

Temperature gradients through solid bodies produce stresses that may affect their load bearing capabilities adversely. Such stresses are directly proportional to the materials coefficient of expansion—under conditions of equilibrium and of uniform gradient—and to the total temperature drop across the section. Under transient conditions, where one surface is suddenly heated or cooled, the stresses will be considerably greater.

Boiler gage glasses, particularly of the flat type, do not have uniform temperature gradients. Furthermore, they are influenced greatly by the arrangement of adjacent metal parts and the extent to which ventilation is effective. As a consequence, the actual stresses involved cannot be determined with any degree of accuracy, although they may reach relatively high values of at least several thousand psi. Stresses will be greater in long gage glasses than in

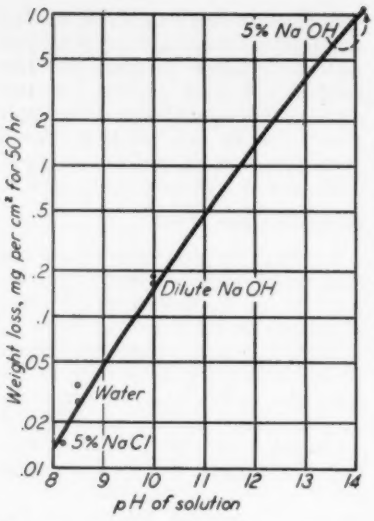


Fig. 4—Attack of alkaline solutions on glass (at 203 F) increases with pH

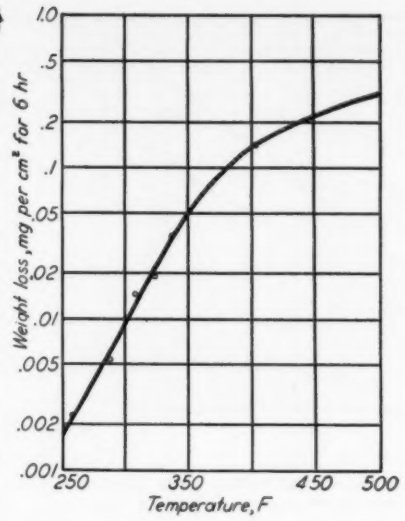


Fig. 5—Distilled water attacks glass more rapidly as temperature increases

short ones because the restraint produced by the gasket materials is not always necessarily complete.

Expansion Problems

Low coefficient of glass expansion is essential so that temperature stresses may be kept within reasonable limits. On the other hand, the differential expansion between the glass and the metals increases. This produces another set of longitudinal stresses in the glass, because it is solidly clamped between the metal parts of the gage, and pressures prevent any appreciable slippage over the gasket surface. This differential expansion must be taken up very largely by shear flow in the gasket material acting as a gage seal.

The resulting stresses are indeterminate. They vary in some way with temperature, the differential expansion between the glass and metal, the plastic flow properties of the gasket, the length of the gage glass, and also the rate of temperature change, (because time is required for the plastic flow of the gasket material). In high temperature work definite benefits can be derived from combined gage and glass design to reduce temperature stresses.

Temperatures, corresponding to the high steam pressures, now being generated, have introduced a new factor in the application of boiler gage glasses. Flat glasses are strengthened by tempering. Residual stresses or strain set up are subject to release at high temperatures, and a considerable part of the strength added by tempering may be lost over periods of high temperature field service.

For the borosilicate glasses, which have been found most satisfactory for gage glasses, this strain release becomes very appreciable at saturated steam pressures between 1250 and 1500 psi. For steam pressures in excess of 1250 to 1500 psi a glass composition less subject to this limitation is desirable. A considerable amount of experimental work and a number of service tests have been carried out with glasses that require much higher temperatures to produce strain release—glasses No. 1710 or No. 1720. (Numbers correspond to glass composition code of Corning Glass Works.) Tests on these glasses have indicated a definite superiority for high steam pressures. Fig. 3 shows the approximate rates of strain release versus steam pressure for glass No. 7331 (representative of borosilicate gage glasses) and glass No. 1720. The comparison has been confirmed roughly from measurements taken on gage glasses, which had been in actual service in the field.

Glass Durability

Glass is a highly durable material for many fields of application. In the specific field of steam boilers, however, corrosion becomes a problem particularly at the higher pressures. This also applies to gages utilized for hot alkali solutions.

Commercial glass compositions, including gage glasses, are all silicates, and the characteristics are determined to a great degree by this constituent. Silica is a material highly resistant to acids, but it is attacked to some degree by strong alkali solution—particularly at high temperatures. Silica is also attacked by distilled water at high temperatures. Other constituents present in commercial glasses will modify their durability characteristics materially from those containing vitreous silica.

In general, alkali constituents are subject to the leaching action of reagents that tend to leave a surface layer, high in silica, on the glass. If the particular reagent involved fails to attack this silica layer seriously the corrosion rate tends to slow down with time. On the other hand, if the silica should be attacked seriously the rate of attack may remain roughly linear with time.

Glass Corrosion

Problems of glass corrosion are complex and involve many variables. There are also wide differences in the chemical durability of different glass compositions. For glasses of high durability, two basic factors determine the relative rate of attack. These are alkalinity and temperature. Fig 4 shows the attack increase with 203F liquid. *(pH refers to room conditions.)* This curve indicates that boiler water with a pH of 11.5 will attack this glass at a rate 30 times greater than water with a pH of 8.5, and indicates low pH importance.

The tests were continued for a period of 50 hr, and they are indicative of relative durability over considerable periods of time. Fig. 5 indicates the relative rate of attack of distilled water on the same glass composition with variation of temperature. The rate of attack, for a 6-hr period, increases 100 times from a temperature of 265 F to 500 F.

With the wide variations in rate of chemical attack shown in these curves minor factors can be expected to produce considerable differences in attack on two boilers, even when the boiler pressures and the pH values of the water are the same. (*Values of pH refer to liquids at room temperature.*) Water temperature in the gage is lower than the water temperature in the boiler, sometimes by a significant amount, in terms of corrosion rate.

A part of the condensate, formed in the boiler connection above the gage, flows into the gage and lowers the alkalinity to some degree. This condensate will also dissolve a small amount of silica resulting from the decomposition of the gage glass, except when protected by mica.

Silica content will increase as the condensate flows downward over the glass and passes into the gage water. If the silica dissolved in the water approaches saturation, the rate of attack on the silica structure of the glass may be reduced very materially. Consequently, the rate of corrosion below water level is dependent to some extent on the amount of silica remaining in the gage water. Above water level, the rate of attack may be found to diminish as the distance increases from the top end of the glass. This is particularly

true for tubular gage glasses. Boiler water, not treated for silica removal, may have appreciable amounts of silica already in solution. This is probably another factor determining the rate of glass corrosion.

Condition of gage water with regard to temperature, alkalinity, and silica content, as compared with the boiler water is determined by the extent of circulation between the boiler and gage. In locomotive boilers, motion increases circulation, and the chemical attack is generally greater than in stationary boilers. Constant rinsing action at water level may also increase the localized attack at this point.

Laboratory Investigation

Extensive laboratory investigations have been carried out to segregate the various factors previously discussed. However, conditions in boiler gages are so complex that the quantitative correlation between laboratory tests and field results represents a very difficult problem. Even minor variations in laboratory techniques have been found to modify the results materially.

Tests involving special techniques offer relatively accurate comparisons between the corrosion rates of various glasses. As a result of such tests, applied to a wide variety of experimental glass compositions, a new glass has recently been introduced for flat gage glasses. This glass, known as No. 7331, offers 2 to 2½ times the service life under attack from mild alkaline solutions, when compared with low alkali content borosilicate glasses previously employed for this purpose.

New Glass Properties

The new glass has excellent properties for boiler gage glasses (except for pressures over 1250 to 1500 psi) and also for other types of liquid level gages. It has a low coefficient of expansion, is adaptable to the tempering process, and retains a clear surface under the action of alkaline solutions. Table 2 gives comparisons between the chemical durability of glass No. 7740; glass No. 7730, formerly used for flat gage glasses; and glass No. 7331, which is now replacing No. 7730 for this purpose. The relative durabilities as shown for the autoclave test have been confirmed by field tests on steam boilers.

Rate of corrosion of a gage glass in any particular boiler cannot be predicted with any degree of accuracy either from laboratory tests or even from data obtained from service experience. On the average, the life of the unprotected glass has been found to become relatively short at steam pressures of 350 to 400 psi. Above these pressures, mica shields between the glass and the water are considered desirable. In this connection glasses No. 1710 or No. 1720 should be installed with mica shields. Opaque films tend to develop on the surfaces under corrosive conditions, in spite of the fact the composition offers resistance against alkali attack in most instances.

Based on all available information—including laboratory tests, generally accepted practice, and specific data from field experience—service recommendations have been established for various types of Corning gage glasses. The recommendations are intended to apply as nearly as possible to meet average conditions with adequate factors-of safety. The fact is recognized that the glasses have, in individual cases, been operated satisfactorily under conditions which were considerably more severe. These recommendations are given in Table 1 for glasses 7740, 7730 and 7331.

Protection Required

No unprotected glasses are recommended for boilers operating at pressures over 350 to 400 psi. For tubular gage glasses the limit is set 50 psi lower. With mica sheet protection flat gage glasses of glass No. 7331 are recommended for boiler pressures up to 1250 to 1500 psi; above this value glasses No. 1710 or 1720 are recommended, because of their high stability against strain release. For low temperatures (-150 F to 150 F) the pressure recommendations are more or less nominal, because so much depends upon the design and arrangement of the metal gage parts. Specific recommendations should be obtained from the gage manufacturer for the particular type of gage structure involved.

Pressure limits for tubular gage glasses decrease with the length of gage. A buckling stress occurs from eccentric column loading rather than the tangential stress alone.

TABLE 1—RECOMMENDED WORKING PRESSURES FOR CORNING GAGE GLASSES

FLAT GAGE GLASSES:

Type of Service	Glass Type	Recommended Working Pressures, psi. Standard Specification Plain - A	Reflex - B	High-pressure Plain - A
Steam boilers (unprotected)	7331	350 - 400	350 - 400	350 - 400
Steam boilers (mica protected)	7331	900 - 1000	———	1250 - 1500
	1710*	———	———	———
	1720*	———	———	2500
Temp, —150 to +150 F (no corrosion)	7331	1500 - 2500	1500 - 2500	3000 - 5000

TUBULAR GAGE GLASSES:

Type of Service	Length, in.	Recommended Working Pressures, Psi. Corning Std. 100 Std. sizes	"Pyrex" high-pressure and "Red Line" glass, 7740 300 - 350 Size, diameter, in. 0.5-0.75	0.875-1.0	1.25-1.50	"Pyrex" heavy-wall glass, 7740 300 - 350 Std. sizes
Steam boilers** —150 to +150 F (no corrosion)	0 - 10	200	500	350	200	600
	11 - 20	200	420	315	165	600
	21 - 30	200	340	300	145	600
	31 - 40	180	290	275	135	480
	41 - 50	160	220	220	125	340
	51 - 60	130	180	180	115	——
	61 - 70	100	140	140	105	——

*Glasses 1710 and 1720 are not a standard product.
**Do not exceed pressures listed for —150 to +150 F.
Note:—Table does not apply to "Pyrex" Red Line glasses.
Use 80% of values given for "Pyrex" high-pressure glasses.

TABLE 2—CHEMICAL DURABILITY

Glass No.	7740	7730	7331
Reagent:	Weight Loss	mg/cm²	exposed surface
5% NaOH — 6hr. @ 100 C	1.4	1.4	0.95
N/50 Na_2CO_3 — 6 hr. @ 100 C	0.15	0.14	0.08
Autoclave test 3 hr. @ 215 C (Solution from Navy Specification 13G-3I par. F-4b)	3.9	3.5	1.5

DON'T CLIP — DON'T TEAR
WRITE FOR TEAR SHEETS!

Rather than spoil this issue for other readers in your plant, let us supply you with copies or tear sheets of any of the articles for your file. Just drop a line attention of the editors—preferably on your company's own letterhead.

Features of a Syste[illegible]at S[illegible]

HIGH-PRESSURE HOT[illegible]

This plant supplies all the steam and hot water for processing operations at Personal Products Corp. and Industrial Tape Corp.

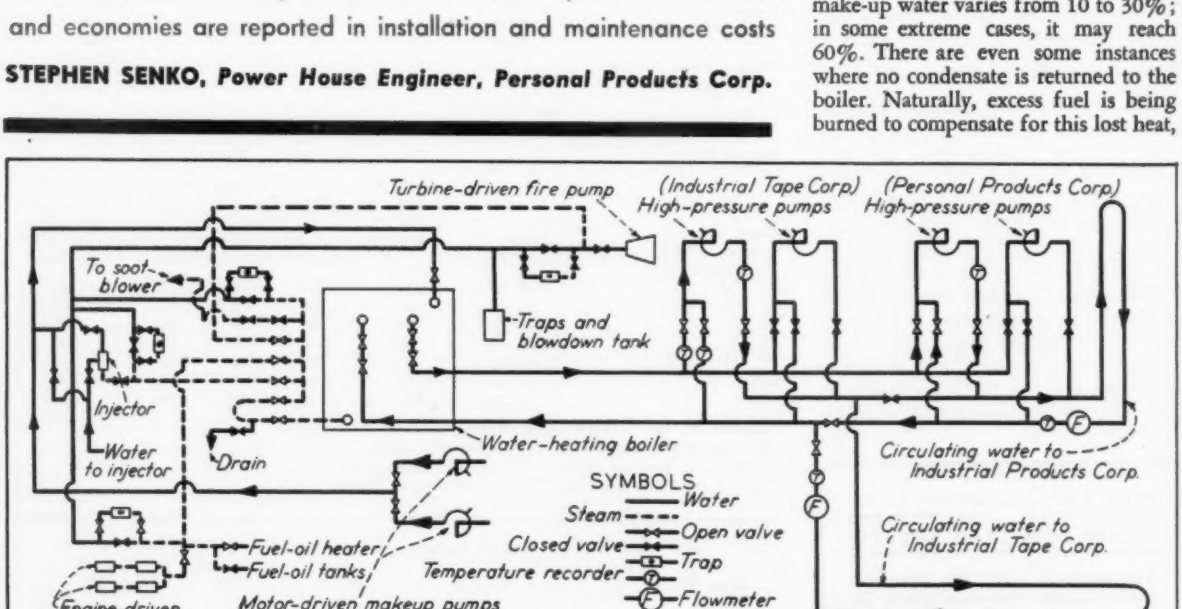
Two manufacturers utilizing the system accrue certain advantages when transmitting heat over long distances in pipe lines of relatively small diameter. Comparisons with steam system are made, and economies are reported in installation and maintenance costs

STEPHEN SENKO, *Power House Engineer, Personal Products Corp.*

HIGH-PRESSURE hot water is an ideal heat carrier and heat accumulator. Furthermore, it can be readily obtained from any industrial boiler. The usual comparison of the respective heat capacities of steam and water is generally made in Btu's per pound. However, a truer picture can be obtained when the comparison is based on the volume of each medium expressed in cubic feet; for example, the heat per cubic foot of steam at 212 F is 42.9 Btu, while the heat per cubic foot of water at 212 F is 10,760 Btu. The ratio at this condition is approximately 250 to 1. This ratio decreases as the temperature and pressure increase, as indicated in the accompanying Table.

Effective utilization of hot water is achieved by making use of all the physical advantages that water can offer for process heating. A completely welded pipe system can be employed, and positive circulation from the heat source to application and return is assured. All possible losses of heating fluid and condensate flash-off are eliminated; and no traps, pressure reducers, separators or other accessories are needed.

Generally in a steam-heated factory, make-up water varies from 10 to 30%; in some extreme cases, it may reach 60%. There are even some instances where no condensate is returned to the boiler. Naturally, excess fuel is being burned to compensate for this lost heat,



Piping layout of high-temperature high-pressure hot-water system. Two boilers, each rated at 43 million Btu per hr, are utilized. There are three distribution mains rated at 110 million, 64 million and 19 million Btu per hr, respectively

HOT WATER FOR PROCESSING OPERATIONS

and fuel bills then rise accordingly.

In a large plant, or in an establishment with a number of scattered buildings, long-distance steam transmission and condensate return might present difficult problems. As steam temperature is a function of pressure, important temperature losses are observed whenever the steam pressure decreases along the mains. Of course, pipe sizes can be increased to avoid extreme pressure drops, but the cost of installation and magnified radiation losses make this procedure highly unsatisfactory.

Temperature Loss

Long-distance heat transmission with hot water can be effective and simple, and does not necessitate excessive pipe diameters. In reasonably large pipe, for example 6 in., the loss in temperature is generally less than 3 F per mile of conduit. This is one reason why high-pressure hot water has been so successfully applied to district heating.

Furthermore, steam installations require pitched pipes and special care to eliminate condensate. Hot-water pipes may be installed in any position as long as free thermal expansion is assured. Pipe radiation remains practically the same for equal pipe sizes, equal covering, and identical temperatures for water and steam. However, smaller diameter pipe frequently can be applied to hot-water systems.

Return of condensate being a problem—and the difficulties increase when long distances are involved—special return pumps and hot wells are needed. This sometimes complicates matters, especially when equipment performance is poor.

When steam is condensed at 100 psi, the condensate obtained will be at the saturated steam temperature, or 338 F. Heat content of the water is 309 Btu per lb. or 129 Btu more than at atmospheric boiling temperature (309-180). This surplus heat will be liberated in the form of steam when the pressure is lowered to atmospheric. Venting of hot wells, therefore, can produce a loss of Btu and distilled water. These deficiencies must be made up in the boiler plant.

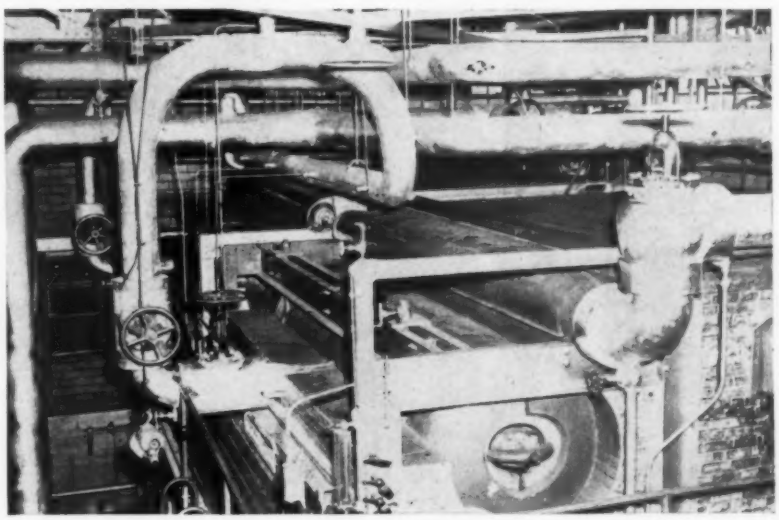
Some engineers refuse to acknowledge a heat loss in condensate return systems, because they use feedwater heaters that absorb Btu's returned from the plant. Nevertheless, such a loss usually exists even though no steam may escape to the atmosphere. The very fact that makeup water must be heated indicates a loss in Btu content, unless all the heat in the steam has been absorbed for processing or other applications. However, this is never the case, because leaks through traps, by-passes and vents add to the inefficiency of the system. In some plants, keeping a heat balance in the feedwater heater is difficult, and some steam is generally "vented" during the summer months. Furthermore, as steam is a colorless vapor and becomes partly visible only when condensing in air, it is often difficult to ascertain if there are leaks in vents, traps and fittings.

Installing high-pressure hot-water systems can overcome some of these disadvantages. Water level in the boiler remains constant, and operating the feedwater pump is seldom necessary. When steam is required, it can be drawn from the top of the boiler while hot water is being taken from the lower portion. In addition, the cost of maintenance of a high-pressure hot-water installation, in comparison with a steam boiler, is considerably less.

The power plant at Personal Products Corp. consists of two boilers each rated at 43,300,000 Btu per hr. There are three distribution mains: a 10-in.

COMPARISONS OF DENSITY AND TOTAL-HEAT CONTENT OF WATER AND STEAM

Pressure, psia	Temperature, F	Density, Water	lb per cu ft Steam	Total Heat, Water	Btu per cu ft Steam	Total-heat ratio, water—steam
14.7	212	59.8	.0373	10,760	42.9	251.0
25	240	59.2	.0573	12,320	66.5	185.5
35	259	58.6	.0796	13,320	92.9	143.5
45	274	58.3	.1063	14,170	124.7	113.5
55	287	57.8	.1285	14,800	151.0	98.0
65	298	57.5	.1502	15,360	177.0	86.8
75	308	57.2	.1720	15,840	203.3	78.0
85	316	56.8	.1938	16,260	229.4	71.0
95	324	56.6	.2152	16,670	255.3	65.4
105	331	56.4	.2365	17,000	281.0	60.5
115	338	56.1	.2580	17,320	306.5	56.6
125	344	55.8	.2790	17,600	332.4	52.9
135	350	55.6	.3005	17,870	357.8	50.0
145	356	55.5	.3215	18,170	383.8	47.4
155	361	55.2	.3430	18,380	410.0	44.8
165	366	55.0	.3635	18,610	434.0	43.0
175	371	54.8	.3850	18,830	461.0	40.0
185	375	54.6	.4060	19,040	486.0	39.2
195	380	54.5	.4270	19,220	511.0	37.7
205	383	54.3	.4480	19,400	537.0	36.2
215	388	54.1	.4690	19,570	562.0	34.8



These pipes, leading off the top of the two boilers, carry hot water to the processing equipment in the plants. Pipe lines are of all-welded construction

line, rated at 110,000,000 Btu per hr; an 8-in. line, rated at 64,000,000 Btu per hr; and a 5-in. line, rated at 19,000,000 Btu per hr. All are based on an 80 F drop. Hot water is circulated by five pumps each rated at 180,000 lb per hr. The two boilers not only furnish all the hot water for heating and processing, but they also meet the needs of a nearby firm, the Industrial Tape Corp., New Brunswick, N. J.

Purchased Power

Electricity is purchased from the local utility. A main substation connected to the utility's 26,000-v line contains the necessary 26,000/4150-v step-down transformers, billing meters and feeders that supply unit 4150/440/110-v substations. Motors are supplied at 440-v, while the lighting circuit is stepped down to 110 v. A synchronous motor that drives an air compressor, and strategically located capacitors help maintain good system power factor for the plant.

Building units have individual meters for electricity, hot-water-temperature and flow, drinking water, sanitary water, and filtered water for process operations. Drinking water is delivered from the municipal distribution system and is metered in the incoming line. Utility rates for power metered at the main substation include a demand charge that is reduced monthly and corresponds to the kilowatt-hours used. This sum is added to the billing rate per kilowatt-hour to distribute the demand charge equitably. After arriving at the total cost of purchased services, each factory unit is charged at the purchased rate for the amount metered. Cost of quantities unaccounted for, such as line and transformer losses, is divided equally.

All filtered water for sanitary and process heating—both space and process—comes from the main filter and boiler plant. Operating and overhead cost figures determine the rates at which metered services are charged.

Service Meters

For instance, hot-water flow is metered at each building and charged for on a Btu basis. Each building has an entrance and exit water-temperature recorder and flowmeter. The total heat, in Btu's, extracted is the difference between entrance and exit temperatures times the weight of water flowing. When temperature curves are wavy, the charted area is planimetered and an average value is obtained. Chart recordings are worked out daily for pounds of water and Btu extracted, and these sums are entered in the log book maintained at the plant.

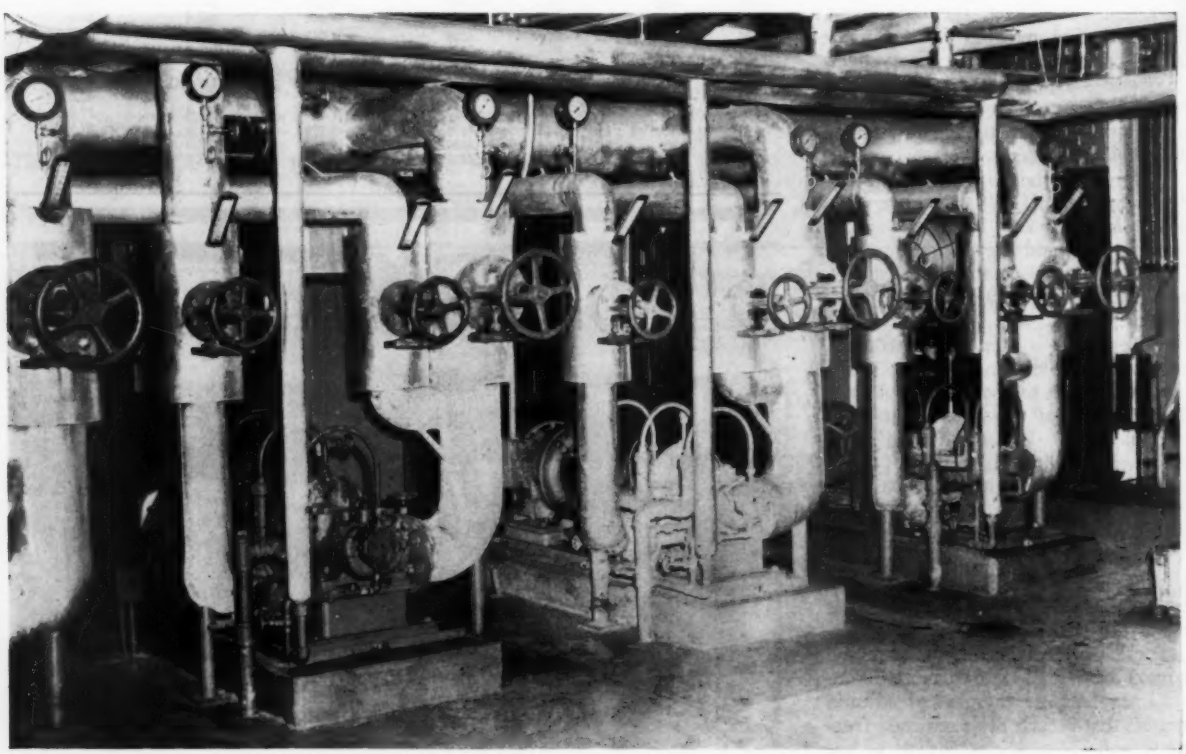
Steam for paper-mill driers is supplied by two boilers each rated at 7,000 lb per hr. These units are inter-connected to the hot-water system. All pressure and temperature controls are pneumatic type, and each control has a built-in recorder.

Advantages

Following are some of the advantages of using high-pressure high-temperature water for plant heating and processing systems: (1) It permits the use of a completely closed pipe system that aids in preventing loss of steam or water. (2) It is not necessary to use traps, pressure reducers, separators and accessories that are subject to frequent repairs and might cause heavy steam losses. (3) Temperatures are not a direct function of boiler pressure and may therefore be adjusted to suit plant conditions. (4) Large accumulation of heat can overcome peak loads easily.

As process heating is only a means to an end, the system should be designed to secure a high efficiency, to demand little or no maintenance, and to be simple in operation.

This article was presented by the author at the January session of the Plant Maintenance Conference.



Shown here are three of the five pumps that circulate hot water to plant heating and processing equipment used by the two manufacturing firms. Each pump is rated at 180,000 Btu per hr. Completely closed pipe system is used to minimize heat loss

Power Surges, with resulting voltage fluctuations, make resistance welding appear impractical on many low-capacity power supplies. Weld schedules, series capacitors or balanced three-phase systems frequently reduce the peaks and pf to the satisfaction of the electrical and welding engineers

CLYDE G. BASSLER, *Vice-president*
The Denton & Anderson Company*

Right—Spot and seam weld processes are fast but require high, intermittent power pulses

KVA REDUCTION IN RESISTANCE WELDING

THE SHORT, HEAVY, intermittent surges of single-phase power usually attributed to resistance welding equipment have made it an unwelcome tenant on many power company lines, as well as on plant distribution lines not close to adequate substations and buses. Consequently, it introduces a difficult problem for the welding engineer, who needs its many advantages, and the power engineer, who must construct the supply lines and make his peace with the power companies. Fortunately, experience and recent developments have compromised many of the difficulties between application and supply, and produced better welds with less disturbance to the power supply.

Where it is applicable, resistance welding will justify considerable trouble, although the job and its economics must be considered individually. It is basically a high production process, and once job and machine are set up, an inexperienced operator produces welds rapidly, with punching or drilling, riveting or bolting, arc welding or brazing—all relatively slow processes—eliminated. Appearance is excellent, with little or no finishing. Thinner metals can be handled. Distortion and other heat effects are minimized. But setup times for short runs, prorated on each piece, and the higher capital investment, *may* make another joining process more economical. On heavier material arc welding predominates, although flash welding frequently is preferred for butt welding rolled shapes and the projection method for joining attachments. The advantages arise from the rapid, localized heating inherent to resistance welding processes.

Difficulties which come from the power surges necessary to produce the inherent heat surges, and from the highly inductive nature of the resistance welding equipment, are summarized by Wood:

(1) Lighting flicker, caused by the fluctuating load of the welder on the distribution lines, produces changes in light intensities. These changes are far more objectionable at some frequencies and hence the allowable voltage drop varies. Summarized, along with the type of welder causing them, the limits are shown in Table 1.

(2) The second problem is that of voltage regulation—limiting the voltage drop at the individual welder to 10%. To the small shop, this is of deep concern, because it probably will be located in an area with limited power supply.

(3) The third difficulty, that of practically no income for the utilities because of the low kwh consumption of a welder load, is frequently a part of the second problem in small shops, since the cost of correction is relatively high. In most cases in the past, the power companies have cooperated and taken the load without extra expense. The future may bring increased restrictions, however, because the low-power-factor, single-phase load causes a voltage drop in the lines that spells trouble to the power company. Whenever this happens, some form of correction will have to be employed. Today, resistance welder requirement charts for listing actual requirements are available from the power companies. If there is any possible way to serve the user without special equipment, they will do so.

Welding machine manufacturers, cooperating with the power engineers,

TABLE 1. DUQUESNE LIGHT COMPANY FLUCTUATION LIMITS

Fluctuation Frequency	Welder in This Class	Change in Volts—115v base	
		Lighting	Power
Over 1 cps	Seam, pulsation	0.5	1.0
1 cps—15 cpm	Spot	1.0	2.0
15 cpm—3 cph	Arc	2.0	3.0

*Representative of the Taylor-Winfield Corp.

have worked on numerous methods of reducing the power surges to the point where they are not objectionable and, at the same time, maintained adequate or improved weld quality. The methods discussed here fall into three classes: (1) use of class B or C welds; (2) series capacitor installations and (3) three-phase systems.

Class B and C Welds. The current-time relationship for making a spot weld in steel of thickness, t_1, is a hyperbolic curve as shown in Fig. 1. Best weld quality is obtained by using the coordinates of point *A*, but often satisfactory results can be obtained by using points *B* and *C*, which involve lower current and longer time. The kva demand is reduced as the square of the current and, if the slight reduction in weld strength is acceptable, this may make it possible for the power company to carry the load. The longer weld time is usually unimportant compared to that of other joining processes. Table 2 compares the requirements and strengths for the three classes of welds.

As an example of the savings in peak demand, the current is reduced from 17,500 amp for a class *A* weld to 10,000 amp for a class *B*. The kva demand is reduced by the square of the current ratio, or to one-third of the class *A* demand. In spite of these facts, the strength is only reduced to about 89 per cent of the class *A* strength, although other factors such as expulsion and surface indentation may have to be considered for acceptable welds.

The next two methods eliminate the effects of the reactive component and not only drastically reduce the kva demand, but also improve the power factor. It should be noted here that class *B* and *C* welds *may* be used in conjunction with series capacitor and three-phase systems.

Series capacitor equipment in a single-phase system cancels out the reactive kva of the welding machine, Fig. 2. As an example, if the uncorrected power factor of the welding machine is 35 per cent, series capacitors will reduce the demand to only 35 per cent of the original. It has always been recognized that this system is a good one for the power company, because the power factor is improved to unity at the same time the demand is so greatly reduced. But there is a popularly accepted opinion that the system limits the flexibility of the welding machine. This is not always true. Rather, experience has widely demonstrated that this system could be used a great deal more to the advantage of the small shop. Here are some actual examples of successful installations:

The first is located in a small town with a municipal power company, a bad situation because the generating capacity is nearly always too small for the community. The shop had no welding equipment at the time the machines were under consideration. The heaviest job is welding two pieces of 20 gage galvanized steel with a throat depth requirement of 24 in. From the chart,

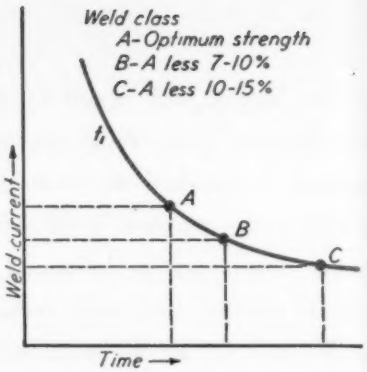


Fig. 1—Spot welds using lower current, for longer time have nearly full strength

20-gage steel requires 9,200 secondary amp, and galvanized, approximately 50 per cent more, or 13,800 amp. The pressure requirement, 500 plus 50 per cent or 750 lb weld force, dictates the RWMA size for the spot welder, which may have a top secondary voltage of 8.46 to deliver 25,000 secondary amp, or 2,948 amp per v. Therefore, 4.8 v at 13,800 amp is 66 kva required at a power factor of 35.6 per cent.

But the power company would allow only about half of this load at unity pf. Therefore, we used series capacitors and corrected to between 98 per cent and unity with a demand of 24.1 kw. The added cost of the series capacitor equipment was $1,354.

The second installation is in a plant having ten spot welders, varying in

TABLE 2—SINGLE IMPULSE SPOT WELDING LOW CARBON STEEL

Data common to all Classes of Spot Welds					Class A Welds					Class B Welds					Class C Welds				
Thickness, each piece, in.	Min. shank* diameter, in.	Max. face* diameter, in.	Min. spacing, c to c, in.	Min. overlap, in.	Weld time, cycles	Tip force, lb	Weld current, amp	Nugget dia., in.	Average shear strength, lb	Weld time, cycles	Tip force, lb	Weld current, amp	Nugget dia., in.	Average shear strength, lb	Weld time, cycles	Tip force, lb	Weld current, amp	Nugget dia., in.	Average shear strength, lb
.010	3/8	1/8	1/4	3/8	4	200	4000	.13	235	5	130	3700	.12	200	15	65	3000	.11	160
.021	3/8	3/16	3/8	7/16	6	300	6100	.17	530	10	200	5100	.16	460	22	100	3800	.14	390
.031	3/8	3/16	1/2	7/16	8	400	8000	.21	980	15	275	6300	.20	850	29	135	4700	.18	790
.040	1/2	1/4	3/4	1/2	10	500	9200	.23	1350	21	360	7500	.22	1230	38	180	5600	.21	1180
.050	1/2	1/4	7/8	9/16	12	650	10300	.25	1820	24	410	8000	.23	1700	42	205	6100	.22	1600
.062	1/2	1/4	1-1/16	5/8	14	800	11600	.27	2350	29	500	9000	.26	2150	48	250	6800	.25	2050
.078	5/8	5/16	1-3/8	11/16	21	1100	13300	.31	3225	36	650	10400	.30	3025	58	325	7900	.28	2900
.094	5/8	5/16	1-5/8	3/4	25	1300	14700	.34	4100	44	790	11400	.33	3900	66	390	8800	.31	3750
.109	5/8	3/8	1-13/16	13/16	29	1600	16100	.37	5300	50	960	12200	.36	5050	72	480	9500	.35	4850
.125	5/8	3/8	2	7/8	30	1800	17500	.40	6900	60	1140	12900	.39	6500	78	570	10000	.37	6150
.140	7/8	13/32	2-1/4	1-1/8	41	2040	18200	.44	8550	72	1240	13600	.42	7960	102	620	10600	.40	7450
.156	7/8	7/16	2-5/8	1-1/4	50	2280	18900	.47	10050	88	1400	14100	.45	9270	125	700	11000	.42	8600
.170	7/8	7/16	3	1-1/2	61	2480	19500	.51	11500	107	1580	14700	.48	10550	152	790	11400	.45	9750
.186	7/8	15/32	3-1/4	1-5/8	73	2770	20200	.54	13250	128	1760	15300	.51	12050	182	880	11750	.47	11100
.200	7/8	1/2	3-1/2	1-3/4	84	2910	20900	.58	14750	147	1940	15900	.54	13420	210	970	12200	.50	12320
.215	7/8	17/32	3-7/8	1-7/8	95	3210	21600	.61	16100	166	2140	16450	.57	14740	237	1070	12500	.52	13500
.230	7/8	17/32	4-1/4	2-1/8	106	3450	22300	.65	17600	186	2300	17000	.60	16200	265	1150	12900	.55	14800
.250	1	9/16	4-1/2	2-1/4	116	3780	23000	.68	18900	204	2520	17600	.63	17500	290	1260	13200	.57	15950
.260	1	19/32	4-3/4	2-3/8	127	4080	23600	.71	20250	222	2720	18100	.66	18760	318	1360	13600	.59	17140
.278	1	19/32	5-1/4	2-5/8	140	4320	24400	.75	21750	245	2880	18700	.69	20200	350	1440	14000	.62	18450
.312	1	5/8	5-3/4	2-7/8	162	4890	25700	.82	24100	284	3260	19800	.74	22850	405	1630	14800	.67	20800

*Shank and face diameters are for 20 deg. cone electrodes.

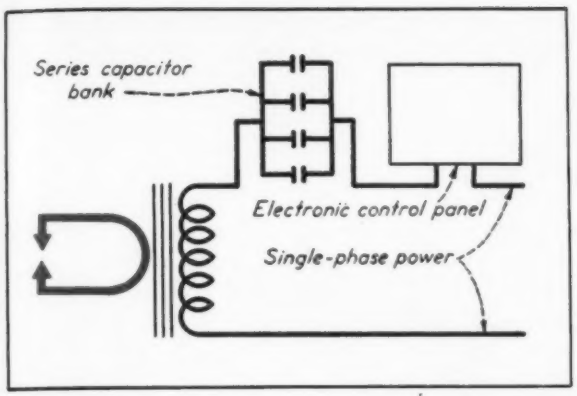


Fig. 2—Series capacitors neutralize inductive reactance of welder to correct pf and greatly reduce kva demand

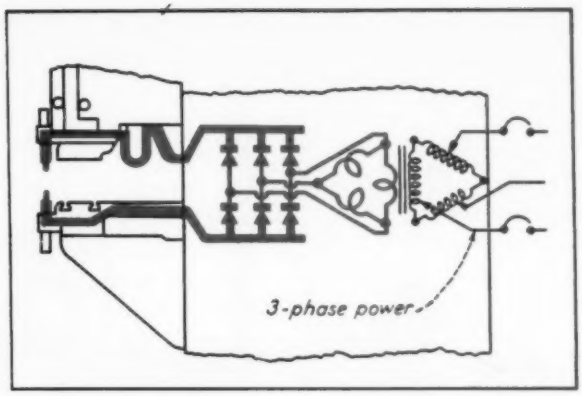


Fig. 3—High-current rectifier supplies dc from balanced three-phase input. No inductive impedance means high pf

size from 10 to 75 kva. For miscellaneous work, machine capacity up to 300 kva was needed. The power factor of a single-phase machine to provide this is around 33 per cent. The power company could not handle this load, but could supply a maximum of 117 kva, corrected to unity pf. A series capacitor installation on a 230-v line achieved the following results, when tuned to the heaviest job of clean 3/16 in. low-carbon steel:

Thickness, in.	Kva.	Kva.	Power factor
3/16-3/16	113.5	112	99 % lag
1/8-1/8	45	42.4	94.1% lag
1/16-1/16	21.2	16.24	76.6% lag

Note the lower power factor on the light gage material. Since the demand is only 20 per cent of the maximum, the power company would accept it. The important point is the flexibility of the equipment. A range of three to one in gage thickness would take care of most small shops, and by reducing the maximum thickness, they could probably have welded 20 gage or less without retuning.

The third installation in the medium size shop covers three different types of machines. Two 40-kva spot welders that had an uncorrected demand of 50 kva at 31 per cent pf were corrected to 22 kva at 95 per cent pf at a cost of about $900 additional for the equipment. A 150-kva projection welder, which had a demand of 148 kva at 40 per cent pf, was corrected to 65 kva, at 95 per cent pf at an additional cost of about $1500. And a 200-kva, 48-in. throat longitudinal seam welder with a demand of 114 kva at 38 per cent pf was corrected to 48 kva at 95 per cent pf at a cost of about $1,000. The latter installation has been in operation for four years with complete satisfaction.

Adequate solutions are possible with spot, projection and seam welders. The flash butt welder presents few problems. The demand is relatively low and the power factor high during the flashing period, which is 98 per cent of the welding cycle. It is only at the end of the welding cycle (except for pre-heating) when the "upset" or forging takes place, that the instantaneous kva demand becomes high. It is of short duration and rarely occurs at a frequency of more than two or three times a minute. If necessary, it can be reduced by the use of double heat cams. At the moment of upset, the high tap is cut out and the lower tap cut in. We have used this in one case, and lessened the demand at upset from around 400 to 240 kva. The duration of this peak was only 15 cycles. On this basis, the company accepted the machine on their lines.

Three-Phase Systems. Other electrical systems that can be employed to obtain the maximum welding performance with the minimum demand are generally of two types; the frequency converter and simple, dry-disk rectifier.

Engineering investigation of three-phase welding machines of the dry-disk rectifier type has been carried on for more than six years. Thought was directed to producing the combination of greatly reduced power demand, three-phase balanced load and high power factor. The result is diminshed power charges, improved line voltage regulation, minimized light flicker, more or heavier welding from an installed power supply, and equalized line currents. Since the power demand of this type welder remains essentially constant regardless of throat depth, welders with deeper throats and increased work clearances may be used. In addition, the three-phase, rectifier type produces a secondary current wave that appears to have the following advantages for welding:

(a) Machines whose head inertia may be too great for fast follow up in a-c projection welding, will operate satisfactorily on d-c because the rate of current rise is relatively low.

(b) The self-regulating effect of the rectifier system (weld current nearly proportional to weld area, inversely proportional to contact resistance) has decided advantages over other systems.

The combination of (a) and (b) produces seam, butt, spot and projection welders with the following benefits—(1) reduced electrode wear and pickup, (2) reduced surface burning, (3) better current and heat distribution in the work, (4) magnetic work or fixtures do not influence the secondary current, (5) less sensitive welding schedules, (6) less sensitivity to changes in work thickness and electrode wear, (7) closer possible spot spacing, and (8) constant current flow produces faster welds.

Out of a spirit of mutual aid and cooperation between the operators of the small shops, the welding-machine manufacturers, and the power companies, the resistance-welding power problems of the small shop are being overcome with more and more success.

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View of Glassboro, N. J., gas plant, showing coal and coke handling equipment

GAS PLANT MECHANIZES COAL, COKE AND OX

Vertical elevators, screw conveyor, and skip hoist are utilized in moving fuel and oxide from railway cars to generating and purifying equipment

SOUTH JERSEY GAS CO. recently completed comprehensive modernization programs at its gas-manufacturing plants in Atlantic City and Glassboro, N. J. With a daily gas production of 17 million cu ft, and gas-storage capacity of 6½ million cu ft, this company serves approximately 260,000 people in Atlantic, Camden, Cumberland, Gloucester and Salem Counties of New Jersey.

Handling facilities for coal, coke and oxide at the Glassboro plant have been completely mechanized. These facilities are illustrated in this article.

Other improvements include the addition of one carbureted water-gas generator, a second purifying box, and a Riley 17,500 lb per hr RA steam generator equipped with a spreader stoker.

In addition, there are three Babcock & Wilcox boilers, two of which burn coal; the other burns tar, a byproduct of gas making. The four boilers produce the steam required in the gas-making process at the plant.

Coal Handling for Steam

The coal is nut or slack bituminous of 1¼ in. size and under, which is received in hopper-bottom railroad cars on a trestle siding.

A 25-ton overhead steel bin, installed outside of boiler room, delivers coal to the stoker hopper of the new Riley boiler. This bin is equipped with a closed chute extending through the boilerhouse wall to the stoker hopper. The chute is fitted with an emergency cut-off gate of rack-and-pinion type. Both the 25-ton bin and the conveyor equipment for filling it, as enumerated below, were designed and built by Link-Belt Company.

1. Steel dump hopper located under the railroad track. It is equipped with a steel grating to exclude lumps and extraneous material larger than its 4-in. square openings.

2. Reciprocating plate feeder set under the hopper. It is driven by a 2-hp motor, and discharges at uniform rate into a vertical bucket elevator which delivers the coal to the overhead bin.

3. A vertical steel-encased centrifugal-discharge bucket elevator, running on 53-ft centers, and equipped with 10x6-in. malleable-iron buckets secured to an endless Class C elevator chain. This elevator delivers coal to a small overhead bin. Handling capacity is 20 tons of coal per hr. It is operated through an elevator shaft by a 7½-hp motor and encased roller-chain drive.

4. Discharge chute running from the bin at the head of the bucket elevator. This chute feeds coal either to an overhead screw conveyor or to a pivoted extension of the chute; the pivoted extension swings through an arc of 180 deg and permits discharge of coal to ground storage.

5. The horizontal, overhead screw conveyor, which is complete with structural-steel supports set on concrete foundations. It is 40 ft long, and has a 12-in. screw operating in a steel U-shaped trough. This trough extends from the head of the bucket elevator to the closed-top overhead storage bin adjacent to the boiler house.

Tractor-mounted scoop feeds the coke skip-hoist loading hopper

ND OXIDE HANDLING FACILITIES

Skip Hoist for Coke

With a new generator added, the Glassboro plant now has three water-gas sets. The fuel for these generators can be either coke or a mixture of coal and coke. Fuel was formerly shoveled into two-wheel buggies at the storage pile and sent up to the charging floor on a platform elevator.

Under the plant's modernization program, a skip hoist now delivers the fuel to a vibrating screen, which in turn discharges it through the roof of the gas plant directly into a weigh larry on the charging floor. The vibrating screen is a Link-Belt unbalanced-pulley unit with a single screening deck measuring 4 ft wide by 5 ft long.

The skip hoist operates automatically. As soon as the 20 cu ft skip bucket has been filled from the automatic loader at bottom of receiving hopper, the bucket ascends to top of its 71-ft lift, discharges, and returns automatically to the skip-hoist pit for refilling.

The receiving hopper is at one side and slightly underneath the railroad trestle on which coke is received in hopper-bottom cars. It measures 10 ft square in plan and is fitted with a steel safety grating. A tractor shovel is used to move coke from the ground stockpile to the hopper.

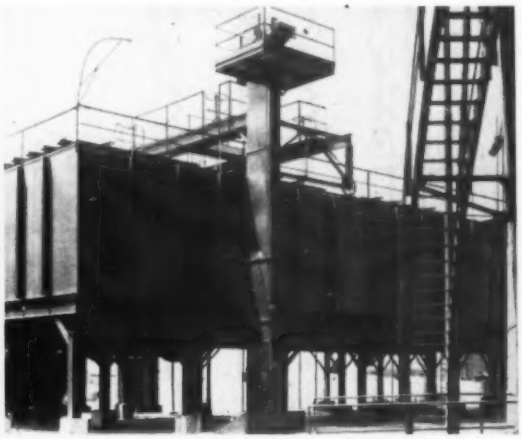
The skip hoist runway and vibrating screen, with chutes therefrom, are supported on a structural steel tower resting on concrete foundations outside the gashouse. An electrically operated wire-rope winding machine for raising and lowering the skip bucket is mounted on the ground at the base of the steel tower. The handling capacity of the skip is 10 tons of coke per hr. This requires 33⅓ round trips of the 20 cu ft bucket. Three skiploads of coke are sufficient for a charge, but the weigh larry employed for charging the generators has sufficient capacity to hold six skiploads.

The skip hoist, steel tower, vibrating screen and chutes were furnished by the Link-Belt Company on a contract through United Engineers & Constructors, Philadelphia, Penna.

Oxide Handling

There are now three gas-purifying boxes in operation at the Glassboro plant. Oxide, the purifying agent, is fed to these boxes by vertical steel-encased bucket elevators of the centrifugal-discharge type. The elevator installed for charging oxide into the new purifying box is 40 ft high, and employs 10x6-in. malleable-iron buckets located at 16-in. intervals on a single strand of Class C elevator chain. The elevator is fed manually from a stockpile of oxide on the ground.

Left: Coal is picked up by a vertical elevator and moved by horizontal screw conveyor to a 25-ton storage bin adjacent to the boiler house. Right: Oxide is fed into the new gas purifier by a steel-encased centrifugal-discharge bucket elevator



DISTRIBUTION OF POWER

Application of these basic principles and workable systems for good power distribution is the key to proper functioning of plant equipment

ALTHOUGH an industrial plant may be equipped with modern electrically driven machinery and laid out for efficient production flow, it is idle investment until power is brought to the motor terminals and utilization equipment. Electrical power may be generated in the plant or purchased from a utility company. From either source it is distributed throughout the factory where needed by the power system. An industrial plant is only as efficient as its distribution network, and the entire output is dependent upon its proper functioning. Hence only the best system and equipment can be economically justified for the system.

Actually, importance of the distribution system is far greater than its proportionate monetary cost, because only 2 to 10 per cent of the plant investment is represented in the majority of plants. Even though the system represents a small portion of the total investment, it should be carefully planned to insure many years of high quality, safe service, and flexibility for future plant changes at low operating and maintenance costs.

Load Center Distribution

When power is generated, or received from the utility company at 15 kv or less, transformation at the point of entry is not necessary, since good industrial practice permits low primary voltage to be transmitted throughout the plant. However, when higher voltage is received from the power company, then transformation is required.

In this article, primary voltage will be referred to as plant distribution voltage. Actual voltage of the equipment, such as motors, will be referred to as utilization voltage. In a plant where the voltage is stepped down for equipment at the point of entry, plant distribution and utilization voltage are the same. Fig. 1 shows a system that

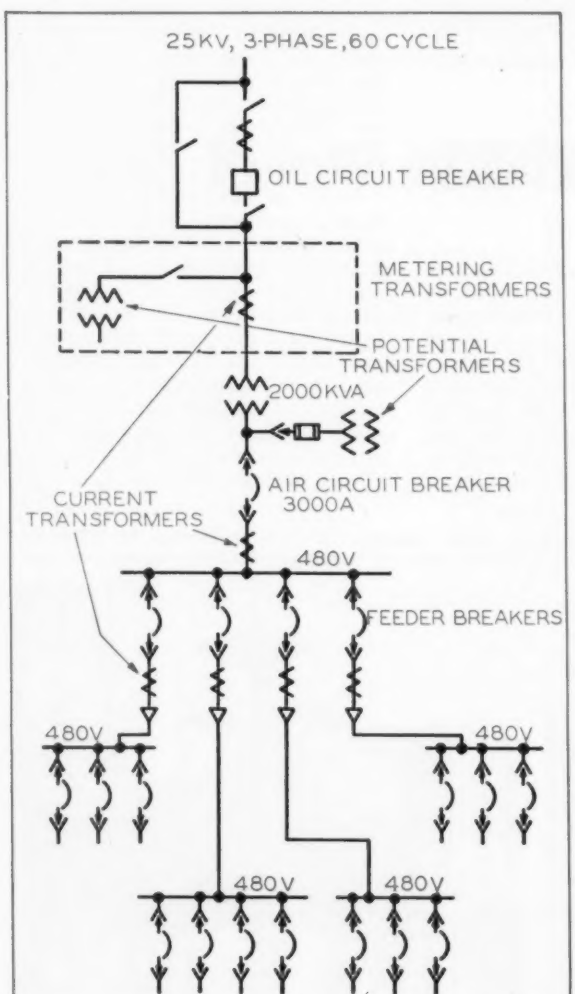
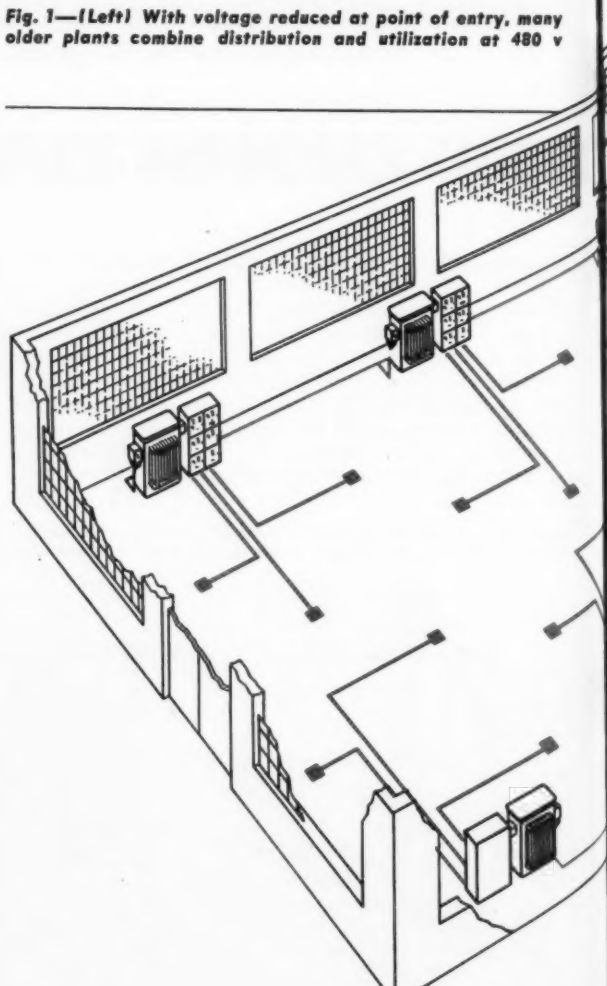


Fig. 1—(Left) With voltage reduced at point of entry, many older plants combine distribution and utilization at 480 v



MEDIUM-SIZED INDUSTRIAL PLANTS

H. R. LLOYD, *Industrial Power Div., General Electric Co.*

has 480 v for a distribution. This practice is typical of many older systems.

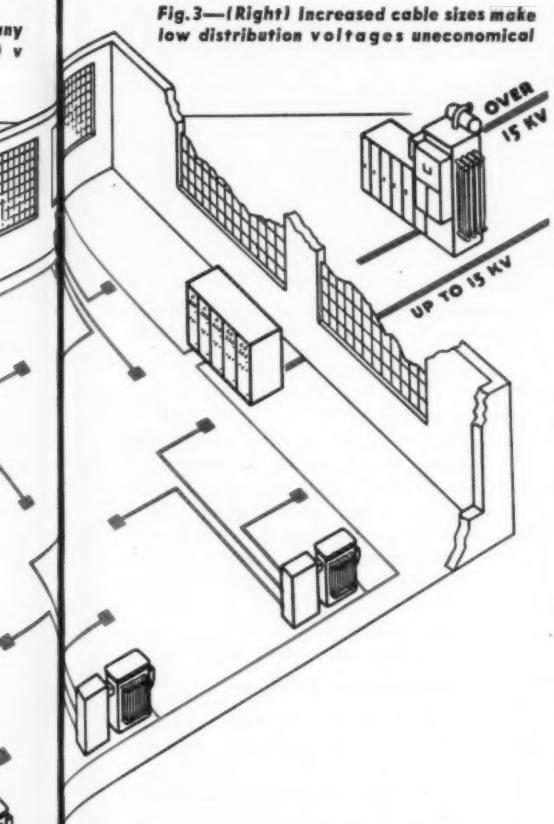
Since, approximately, for a given kva, losses in a circuit vary inversely as the *square* of the circuit voltage and the per cent voltage drop and current vary inversely as the first power, as high a voltage as possible should be selected for both the plant distribution system and the secondary utilization equipment. Fig. 3 shows how copper requirements increase as circuit voltage decreases. These same reasons make it worth while to carry the power as near as possible to the utilization point with the higher primary voltage.

A load center system is laid out to transmit power at the primary voltage to the center of the load area. The voltage is then stepped down to the secondary or utilization voltage (600v or less). The system, Fig. 2, has many advantages over the old scheme of stepping down to the utilization voltage at point of entry and employing this as the plant distribution voltage. The various advantages are: (1) lower overall cost, (2) short circuit current bottleneck removed, (3) greater flexibility of expansion, (4) reduced voltage drop, and (5) reduced losses.

Basic building blocks of any load center system are unit substations. Generally, they consist of a flexible combination of incoming line units, transformers, and secondary low voltage circuit arrangements with air circuit breakers located near the load areas as required. Load center units can be furnished with oil, air, or dielectric-filled transformers and can be built for indoor or outdoor locations. A typical load center unit substation with air-cooled transformer is in Fig. 4.

Often there will be a multiplicity of low voltage motors to be controlled in a given area. All the motor controls may be grouped into a single control

Fig. 3—(Right) Increased cable sizes make low distribution voltages uneconomical



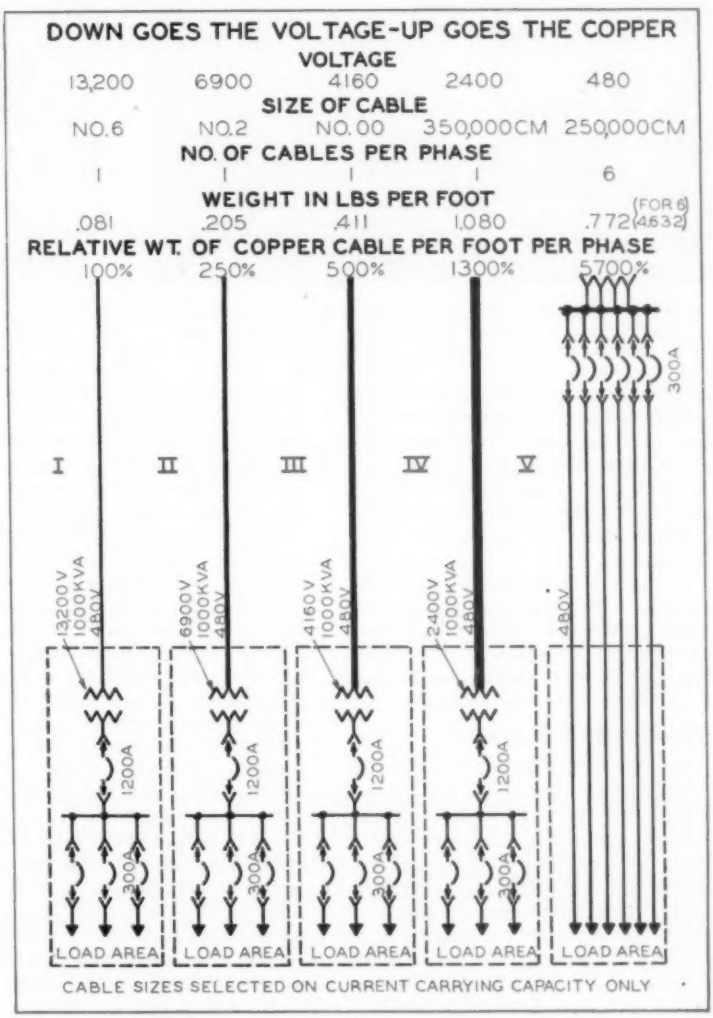


Fig. 2—Modern load-center distribution system divides the plant layout into load areas, each with unit substation. Power, distributed at 2.4 to 15 kv, is transformed to low voltages for control and equipment. Cost, losses and voltage drop are less and the flexibility for expansion is greater

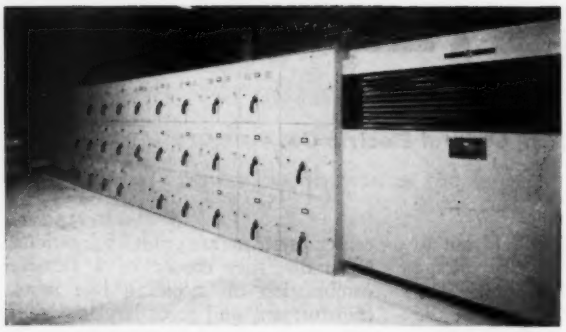


Fig. 4—Unit substations are complete for specific requirements. This one has air-cooled transformer

Fig. 5—Motor-starter substations allow centralized motor control with load-center distribution system

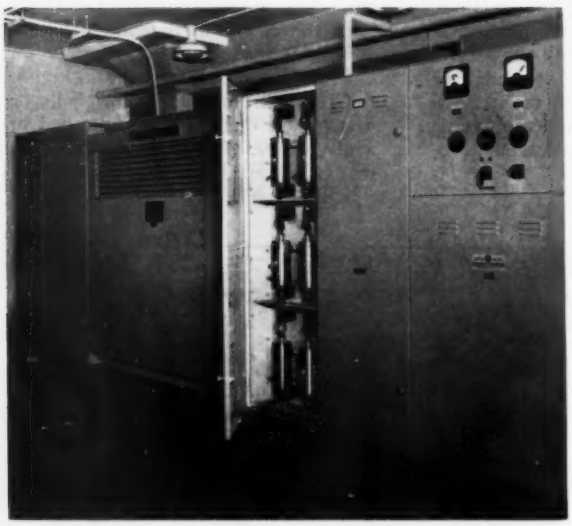


Fig. 6 — Ignitron rectifier, transformer and switchgear supply d-c power from another typical load unit

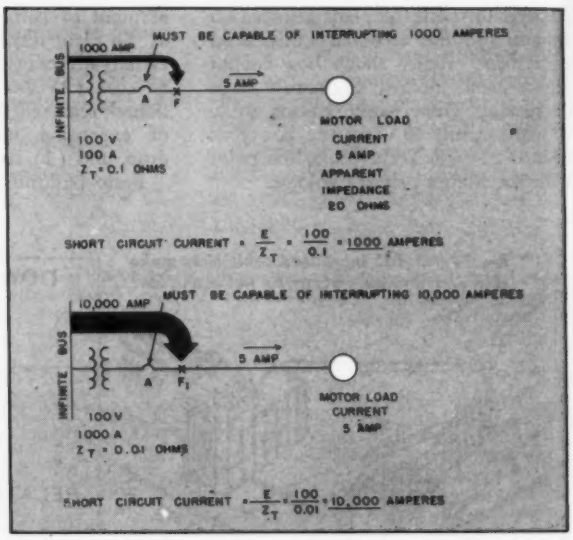


Fig. 7—Higher kva capacity means lower impedance, requires protection for higher short-circuit current

unit, which in turn can be throat connected to the stepdown transformer that furnishes power from the plant distribution voltage. Motor-starter unit substations, such as shown in Fig. 5 offer the advantages of both centralized motor controls and load center distribution.

D-c unit substations that can be installed to supply d-c power requirements consist of a sealed-ignitron, mercury-arc rectifier section as well as the transformer and suitable switchgear. Fig. 6 shows a d-c unit substation.

Short Circuit Currents

Current flow through all components of the electrical system must be considered on two bases, normal full load current flow and short circuit current flow. Current flow under normal conditions generally seems to have adequate recognition. However, flow of short circuit current imposes mechanical and thermal stresses on all components of the system, including the circuit breakers, disconnect switches, buses, power cable and current transformers; and for this reason consideration of load currents for proper equipment application is important.

Many engineers disregard short circuit currents entirely and their plants, as a result, are operated with inadequate protection. Actually the value of short circuit currents is often easier to determine than the magnitude of load current. Simplified, widely accepted procedures approximate the value of fault currents well enough for most cases.

Magnitude of load current is related to the amount of work being accomplished, and there is little relationship to the size of the power system supplying the utilization devices. Short circuit current, on the other hand, bears a converse relationship, being somewhat independent of the load but directly related to the capacity of the power system. Obviously, the greater the power source, whether plant-owned generators or sub-station transformers, the greater will be the short circuit currents as shown in Fig. 7.

Many industrial plants have outgrown capabilities of their system and are inadequate in short circuit protection. Expansions have increased electrical load with no consideration of short circuit potentialities. In old plants the problem is acute; insulation deteriorates and the likelihood of short circuits becomes more certain with age. When faults occur, major shutdowns can be caused with extensive damage to property and injury to personnel.

Distribution Voltage

Main choice of power distribution voltage being considered depends on plant size and can be a secondary voltage of 600 v and below, or one of the standard voltages, 2400 or 4160 v. For reasons already shown, anything below 600 v can generally be eliminated as a desirable distribution voltage.

In comparing the 2400 and 4160 v systems, rarely will distribution at 2400 v be more economical than at 4160 v. Exceptions involve instances where incoming power is at 2400 v, and when

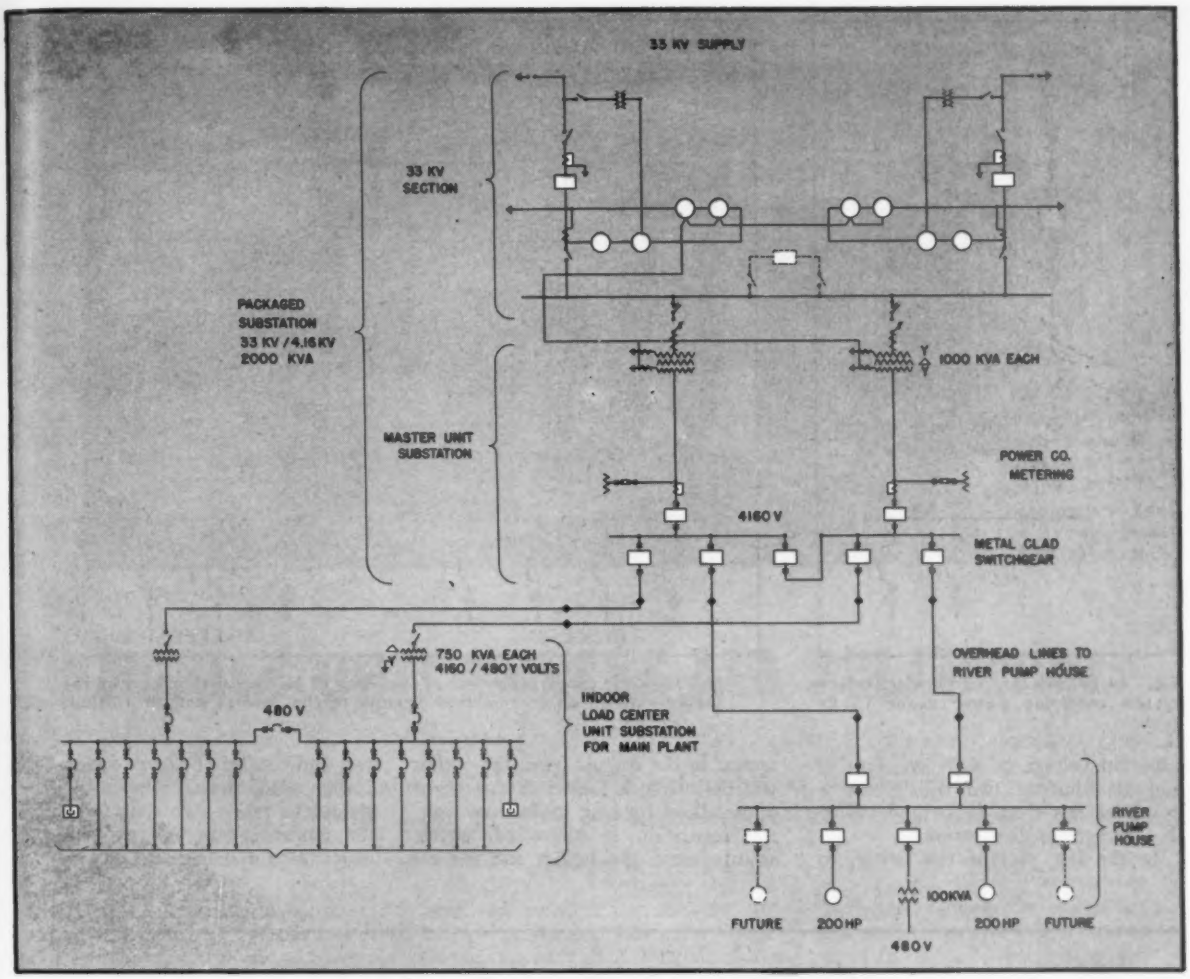


Fig. 8—Typical load-center system for power received at voltages above 15 kv, transformed to intermediate distribution voltage, and then to utilization voltage at unit substations in various sections of the plant

a major part of the load is composed of motors individually rated more than 200 hp in combination with a compact geographical arrangement permitting distribution circuits of short length. The distribution voltage of 4160 v will be generally more favorable economically because the slightly greater motor and control cost will be offset by the lower cable, and perhaps switchgear cost. Motors below 200 hp are served more economically at 480 v. Transformation costs are approximately the same for either of the voltages considered and this item will not influence the comparison.

Distribution systems of 4160 v instead of 2400 v, in addition to economic gain, have the advantage of operating at higher kva levels with the same short circuit equipment cost. This means the connected capacity on the bus can be greater for the 4160 v systems than the 2400 v systems. Limitation of connected capacity per bus section is approximately 7500 kva at 2400 v and approximately 12,500 kva at 4160 v. Up to about 10,000 kva total connected capacity, 4160 v should be given first consideration. Where the anticipated ultimate size of the plant will exceed this kva, consideration should be given to the use of 13.8 kv as the distribution voltage.

Outdoor package substations can be utilized to step down to the plant's distribution voltage of 2.4 kv to 13.8 kv. These units are complete, from the strain insulators to the outgoing terminals of the feeders. They can also include lighting, metering, complete bus arrangements, transformation, and secondary feeders.

Utilization Voltage

Three utilization voltages most commonly employed for supplying motors are 240, 480, and 600 v. The 480 v system is by far the most common and is considerably more economical than the 240 v system because of the decreased cable costs. A 600 v system will be less expensive for the switchgear and cable involved, but 550 v motors and controls are not generally stocked. Hence, it does not enjoy the usage of the 480 v system. There will generally be some 120 v load which can be furnished through dry type stepdown transformers.

Layouts of typical systems are shown in Figs. 8, 9, and 10. Fig. 8 shows a system that receives power above 15 kv and utilizes an intermediate plant dis-

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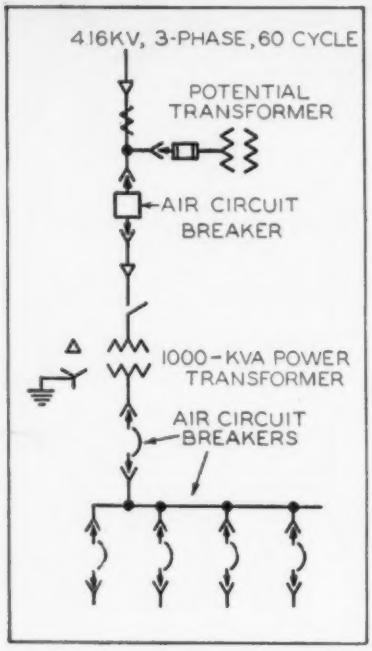


Fig. 9—Layout of small distribution system receiving power under 15 kv

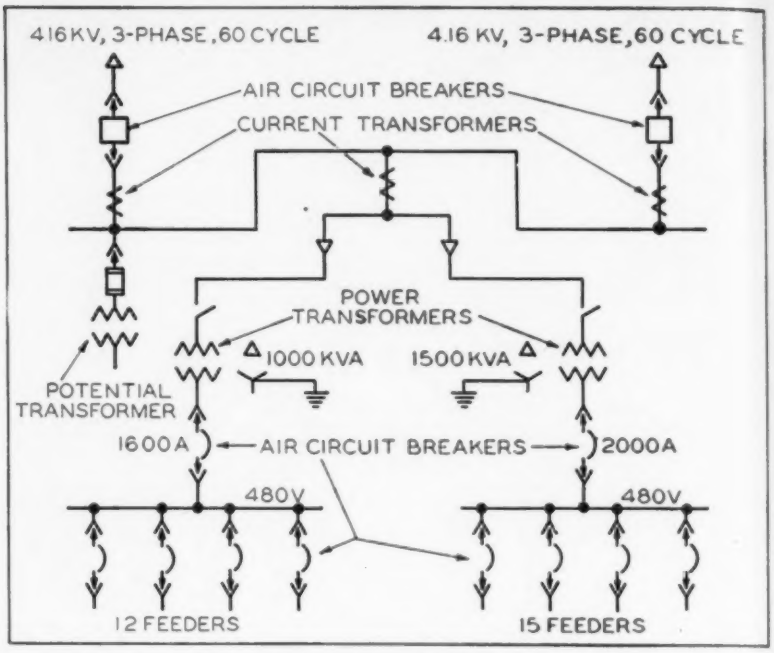


Fig. 10—Also receiving power at less than 15 kv, this system carries the supply voltage on branch lines directly to the various unit substations

tribution voltage of 4.16 kv. Figs. 9 and 10 illustrate two which receive power at less than 15 kv and utilize this voltage for distribution.

In the last part of the article, to appear in the August issue, the author will discuss such factors as the means of handling lighting loads, how voltage regulation is controlled, circuit arrangements, grounding, and the effect and control of power factor. The author also shows why all phases should be taken into consideration in the modernization and expansion of distribution systems.

High Efficiency for Mercury-Steam Cycle

●Unusual conditions of temperature and pressure were met in the design and construction of two mercury boilers by The Babcock & Wilcox Co. for a new power plant operating on the mercury steam cycle with no separate steam boilers.

The new plant is the Schiller Station of the Public Service Co. of New Hampshire at Portsmouth and was designed and built by the General Electric Co. The two B & W mercury boilers generate the mercury vapor and superheat the steam used in the cycle, the first time that no steam is generated from the combustion of fuel.

In the binary cycle, mercury vapor is generated, produces power in a mercury turbine, and the heat exhausted produces steam which, in turn, generates power in a steam turbine. Each of the two mercury boilers serves its own 7,500 kw mercury turbine and the steam produced by both serves a 25,000 kw steam turbo-generator, making the installed capacity of the combined units 40,000 kw.

Mercury-Steam Cycle

The mercury boilers, equipped for either oil or pulverized coal firing, generate mercury vapor which passes through a turbine driving an electric generator and exhausts into a heat exchanger or condenser boiler. Due to the high residual temperatures of the exhausted mercury vapor, as compared to steam, the heat given up in the exchanger produces steam in the condenser boiler at approximately 650 psi.

The steam is taken back to a superheater located in the combustion gas outlet of the mercury boiler to be superheated to approximately 825 F. The superheated steam from each mercury boiler is combined and serves a 25,000 kw turbo-generator. The steam part of the binary cycle is similar to that in any steam plant. This plant, at design rating, is expected to have a net heat rate of 9,200 Btu per kwh.

The high fuel costs at Portsmouth are offset by the low heat rate of this cycle, and the plant is the most efficient of its size or installed capacity.

Construction of Boilers

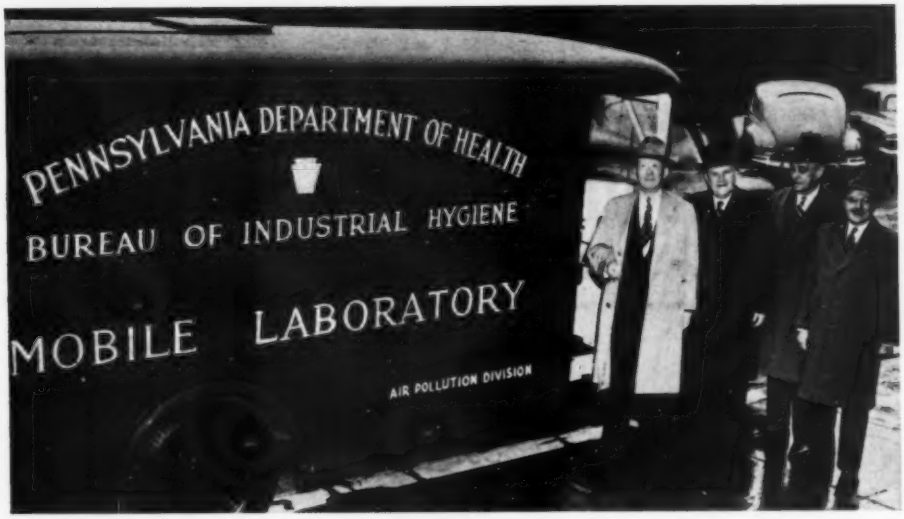
Mercury drum and the wall headers which are not exposed to the fire are of SA-280 ½ chrome. Wall tubes exposed to the fire are of Croloy 5 Si.

The furnace is completely mercury cooled by walls of tubes on approximately 1¾ in. centers. As the specific volume of mercury changes rapidly with increase in temperature and the formation of mercury vapor, the ID of the tubes increases from ¾ and ⅞ in. at the bottom to ⅞ and 1 in. at the top.

The tubes are welded to top and bottom headers at The Babcock & Wilcox Tube Co. shops. Eighteen wall sections, each having 28 to 32 tubes, were prefabricated and shipped to the job site.

At the top of the front and rear walls, the tubes form a convection heat exchange bank, called the fog bank, the tubes of which are joined to the mercury drum.

Six large downcomers from the drum feed the lower header of each front-, rear- and side-wall section.



Gov. J. H. Duff of Pennsylvania; MSA president, G. H. Deike Sr.; State Health Dept. Sec., Dr. Norris W. Vaux; & Hygiene Bureau Dir. Dr. J. Shilen

MOBILE UNIT CHECKS AIR POLLUTION

Portable laboratory is complete and self-contained, and ready for practical field use in studying atmospheric problems in any area

PENNSYLVANIA'S new air pollution and industrial hygiene mobile laboratory, has just been placed in service by the State's Bureau of Industrial Hygiene. Designed and supplied by the Mine Safety Appliances Co., the laboratory is equipped with more than twenty five scientific devices for field sampling and quantitative and qualitative analyses of atmospheres in industrial communities and factories.

Because some surveys will be made in locations without power or water supplies, the unit is equipped with: (1) a gasoline motor driven generator for electrical service, (2) a 30-gal fresh-water tank, (3) a 10-gal distilled-water tank and (4) two liquified petroleum gas tanks to supply fuel for Bunsen burners. A separate ventilating fan is installed, and the laboratory has a weathertight connection for an outside power source.

Other equipment, individually compartmentalized in rubber-cushioned racks and drawers includes: (1) An electrostatic sampler, with which laboratory technicians can sample atmospheres for all types of particles, including dust, fumes and smoke resulting from many industrial processes. Operating on the principle of electrical precipitation, this sampler has a portable head, which contains an ionizing electrode, a collecting tube and motor-blower assembly that provides for a flow of three cubic feet per minute. Particles present in the incoming air are charged and deposited on the collecting tube. Determinations then can be made by weight without removing the sample, or further tests can be undertaken by extracting the samples.

(2) Two portable hand-operated Midget Impingers, also part of the laboratory equipment, are used to collect dust samples in out-of-the-way places. (3) Special instruments developed for separate detection of hazardous gases or fumes such as carbon monoxide, chromic-acid mists, nitrogen dioxide, benzol and hydrogen sulphide.

(4) An Explosimeter and Combustible Gas Indicator. (5) A full complement of meteorological instruments, because weather conditions have an important bearing on air pollution.

Laboratory will be under supervision of the State's new Air Pollution Div.

Equipment inside the laboratory is arranged compactly and conveniently for testing atmospheric contamination in any locality

AUTOMATIC SPEED CONTROLS MEET VARIED REQUIREMENTS

FRANCIS A. WESTBROOK

THE SECOND, *and final part of this article explains several typical automatic speed-control systems.*

To maintain automatic uniform velocity control a hook-up such as shown in Fig. 1 has given satisfactory results in numerous cases. This method is not applicable for light or fragile materials, for example, but it could better be handled with a hydraulic system. Variable speed shaft is connected to the wind-up, or unwind reel. The constant speed shaft of the variable speed unit is connected to an outside shaft of the differential, and the other outside shaft is connected to a contact roll and is driven by it. The differential center shaft is connected with the speed changing screw on the variable speed unit.

As the diameter of the wind-up roll increases the material travels faster. This variation in speed is transmitted to the outside shaft of the differential through the contact roll. The other outside differential runs at constant speed, so a change in speed of the contact roll produces an unbalance in the differential. The unbalance causes the center shaft to rotate and adjust the speed-changing screw of the variable-speed transmission. Thus the two outside shafts of the differential are kept running at the same speed; and the wind-up-roll speed is automatically decreased as the diameter increases. In this manner the material being wound is maintained at constant velocity throughout the process.

Another practical use of the differential is in synchronizing two machines when there is no web of material between them and when the drive shafts are widely separated. A layout for a differential control for synchronizing the speeds of a kiln and its feeder in a cement plant is seen in Fig. 2. When the setting of the variable speed unit in the kiln drive is changed manually the speed of the variable speed unit in the feeder drive is automatically adjusted by means of the differential.

Hydraulic automatic control is also used to synchronize machines or sections of a machine, to maintain constant tension and uniform peripheral winding speeds and to maintain uniform pressures, liquid levels, temperatures, weights and other variables. It is very sensitive and a pressure of only a few ounces on the extended control lever changes the speed. Hydraulic automatic control reaction is fast. In fact it takes only from 6 to 20 seconds to shift from minimum to maximum speed, depending on the speed ratio and size of the variable speed unit.

A two-way rotary, oil tight valve —mounted integrally with the oil pump cylinder—is actuated by an extended lever connected directly or by cable to an indicating member of the controlled machine. Air pressure may also be used. Control may be effected by means of a floating (or "dancer") roll, follower roll, or by connecting the extended lever to some moving part of a machine.

Typical example of the hydraulic control application is the veneer lathe (Fig. 3). The indicating lever of the control is connected with the knife car-

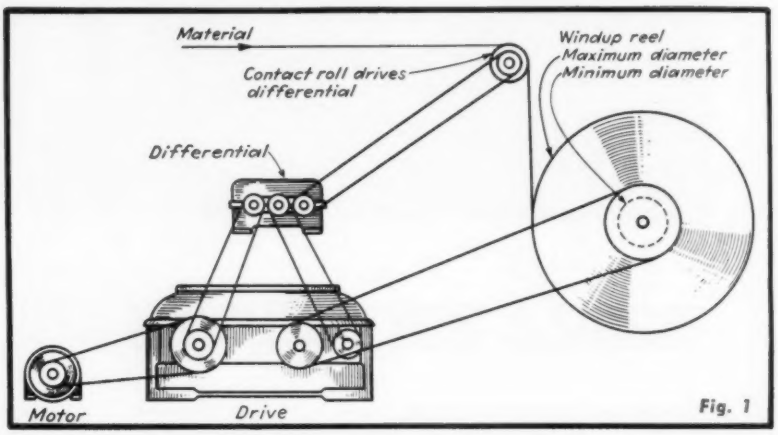
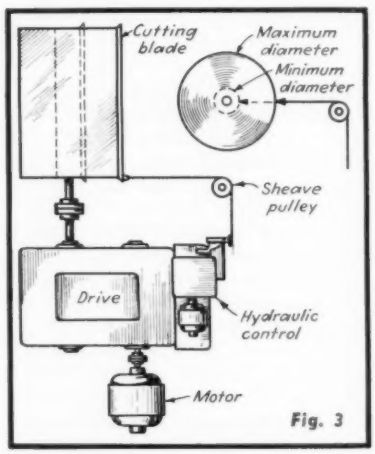


Fig. 1—Differential automatic control system maintains a constant velocity of material by varying peripheral speed

Fig. 2—Kiln and feeder speed are kept constant in this cement plant by a synchronous differential automatic control

Fig. 3—Veneer-lathe-knife speed is controlled hydraulically to conform to the peripheral speed of the log being cut

Fig. 4—Constant liquid level is maintained with a variable speed control in conjunction with bubble-pipe regulator



Applications, for hydraulic and differential speed control in the paper and cloth, veneer, cement and chemical industries, along with maintaining liquid levels, offer engineers a basis from which to select the right method for variable speed problems

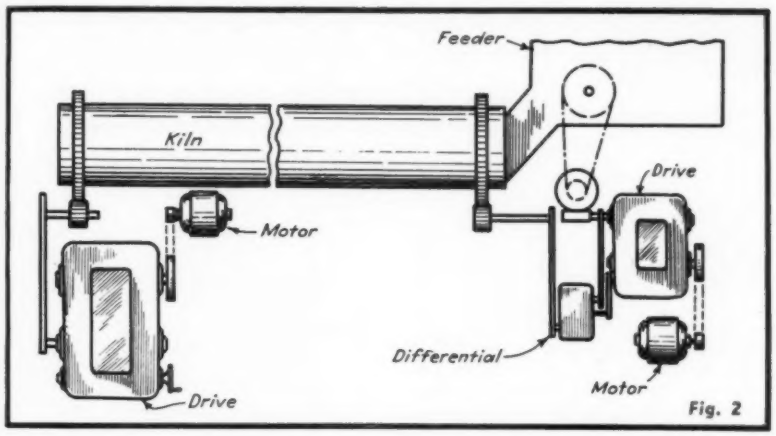


Fig. 2

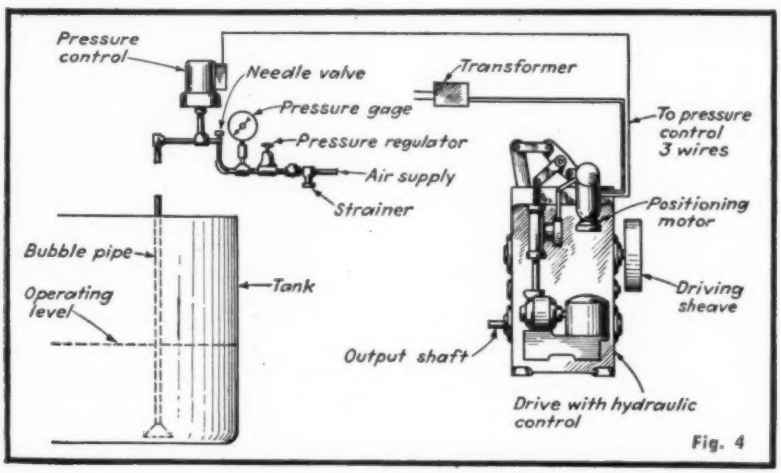


Fig. 4

riage by cable. As the knife carriage moves forward and approaches the diameter of the roll, the speed of rotation of the log is automatically increased, and a substantially uniform peripheral cutting speed is maintained. When the knife carriage moves back to start cutting a new log, the speed is automatically reduced.

Fig. 4 shows application of a diaphragm regulator associated with hydraulic control to maintain liquid levels or pressures in a tank. In this case a diaphragm has been placed in the side of a filter tank, and the stem of the diaphragm is attached to the indicating lever of the hydraulic control. When the liquid rises up to the diaphragm, or over it, the stem is pushed out. This action actuates the hydraulic control which, in turn, automatically adjusts the variable speed control unit to increase the filter speed. When the liquid is lowered, pressure on the diaphragm decreases, the stem reverses its direction, and reduces filter speed.

Constant liquid level in filtering and refining operations may be maintained by the use of a float, instead of a diaphragm, to adjust the variable speed unit automatically through a hydraulic control. For instance, in filtering operations in the paper and pulp industry the variable speed unit drives the vacuum filter drum. Drum speed is automatically regulated by the float and hydraulic control so that the drum remains submerged at a constant level. With this arrangement 90 to 95 % of solid material is recovered, and it is possible to vary capacity in accordance with variations in the flow of white water through the system.

Another type of automatic control for maintaining a constant liquid level in a tank is known as the bubble pipe regulator. It is said to be the most accurate method for liquid level applications and is also applicable for filters and pumps.

With a normal water level, the back pressure of air bubbling through the liquid does not register on the pre-set pressure control. When the level rises above normal, air pressure in the bubble pipe rises and is picked up by the pressure control, which then energizes a control motor. The latter shifts the hydraulic control which, through the variable speed unit, speeds up the pump drawing liquid from the tank. After the level has been returned to normal, the pump speed is automatically reduced. If the liquid should drop below normal, the pump speed is similarly reduced until the tank is filled to the normal setting. A comparable arrangement can be used to drive filter drums.

Automatic control of variable speed transmissions is possible for a wide variety of applications in addition to those described. Standard equipment is available for a great many of them, and special equipment can often be devised to meet a specific condition. In any event automatic variable speed control is a highly technical branch of mechanical power transmission, and it is practically always advisable to consult with the manufacturers before purchasing such equipment.

Acknowledgment is made by the author to Reeves Pulley Co. for the drawings appearing in this article.

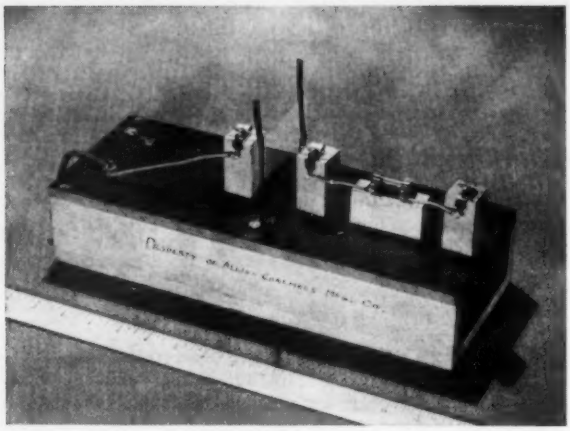


Fig. 1—Spark gap made of simple parts with needle spacing adjustable for voltage. Paper shows puncture from flash-over

Testing Circuits for

VOLTAGE SURGES

Connected to suspected equipment, an easily made device leaves a tell-tale indication that dangerous high-voltage surges have occurred

FRAZER JEFFREY, *Electrical Engineer*
Allis-Chalmers Manufacturing Company

DAMAGE FROM VOLTAGE surges easily can be confused with that from other causes. Frequently, a certain machine may fail under conditions, which appear definitely to indicate a weakness in the insulation. Actually, the trouble may be caused by lightning or switching. Overvoltage comes in the form of traveling waves or surges of potential sometimes as much as four, six, eight, ten, or more times normal operating voltage. Machines have been rewound and repaired time after time with the thought in mind that the insulation of the equipment was substandard, but where, in time, the trouble was found to be caused by line surges.

While a number of machines may be operating close to each other, it is possible that one of them may break down continually if surge conditions exist. This happens because the surge impedance of that particular machine is critical or in resonance wth the impedance in that particular system or feeder. The traveling surges build up a high counter emf and follow the path of least resistance, causing difficulty in this one particular machine circuit.

Where surges are suspected, their presence can be established definitely by tell-tale needle-point air gaps, Fig. 1, connected to the terminals of the machine in question. The circuit of this device is shown in Fig. 2, while the needle-gap spacings are shown in Fig. 4. For a three-phase machine, a needle gap is connected in series with a resistor between each motor or generator terminal and ground, Fig 3. Resistors should be one ohm per estimated volt of surge.

If the gaps break down, the spark passes through the thin piece of paper. Frequent examination will indicate whether or not there has been a surge. As the small holes are not easily discernible, very careful inspection of the paper should be made.

For a 2,200-v machine, the needles might be set to break down at approximately 4,000 v. If a break down occurs, reset the points for 6,000 v, then 7,500, 9,000, and so on. If surges of 6,000 v or higher are occurring regularly on this particular 2,200-v circuit, find the cause and correct it.

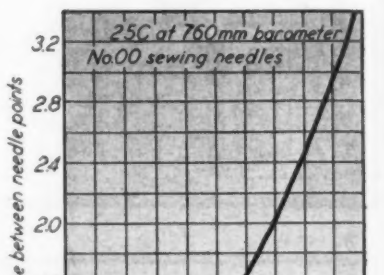


Fig. 4—Puncture in tell-tale paper indicates that the voltage has surged higher than the corresponding sparking distance on the "breakdown" curve above

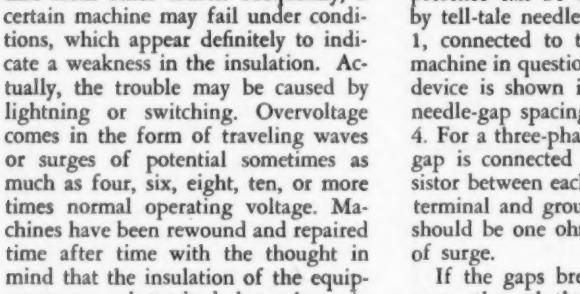


Fig. 2—Circuit diagram for gaps. Non-inductive resistor limits spark current; fuse blows on continued flashover

Fig. 3—Three gaps such as those shown in Fig. 1 should be used to detect voltage surges in three-phase equipment

Plant Engineer's Handbook

COMPILED BY GENE FELLER

ELEVATOR CONVEYORS

WILBUR G. HUDSON, *Consulting Engineer*

IN THE JUNE ISSUE, we discussed some of the factors to consider when contemplating the installation of a screw conveyor. Here we will analyze suitable machines for elevating material along a vertical or nearly vertical path.

Coal usually is in sizes readily handled by any of the standard centrifugal-discharge, continuous-bucket, or gravity-discharge bucket elevators shown in the sketch. The *centrifugal-discharge* unit (A and B) is a high-speed machine, lowest in first cost, and frequently the best for moderate capacities.

The *continuous-bucket* elevator (C) usually receives consideration where the desired capacity exceeds 75 tons per hr. It has the advantages of slow speed (100 fpm or less), thus eliminating most of the noise coming from the slap of a high-speed chain against the head sprocket. Also, it has longer life, compensating for the higher first cost of the equipment.

The *gravity-discharge* elevator (D) can turn from a vertical to a horizontal run—as for distribution to a bunker. It has a speed of 100 fpm or less, and is available in capacities up to 100 tph, or more.

If the upper horizontal run is longer than 50 ft the inverted-L path (D) has one objectionable characteristic. The double run of chain and buckets, the trough, and chain guides, cost more than a centrifugal-discharge or continuous-bucket elevator with a tandem-screw conveyor. Thus, it is specified less frequently because it has no compensating advantage.

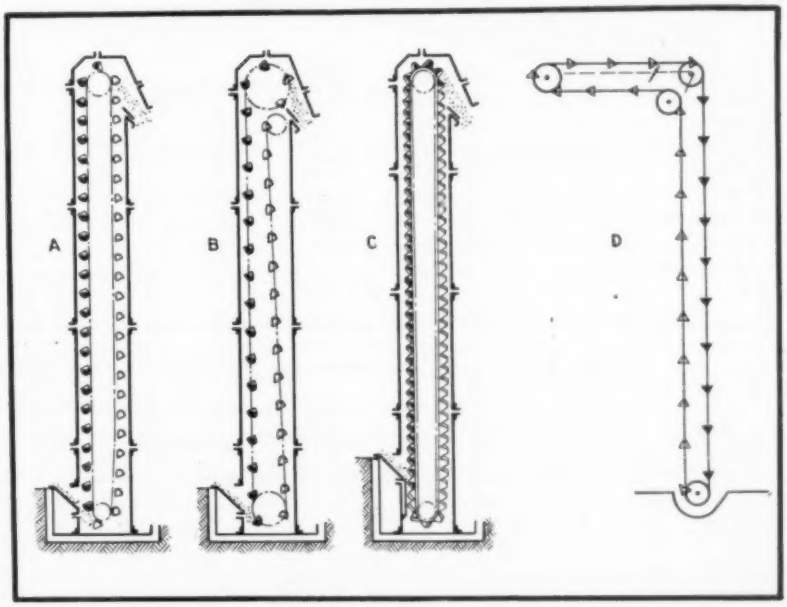
Where possible, a vertical elevator is advisable. For an inclined path we must have a double-strand machine and the chains roll or slide upon guides along both runs. It is not a rare occurrence for the guides to wear through. Then the chain snags and causes a bad mess. A belt-and-bucket elevator need not involve this objection as the loaded run is carried on rollers and the return run hangs free. But a rubber belt does not stand up too well in contact with coal—especially if the coal has been sprayed with oil.

A bucket elevator must be provided with a feeder to assure a suitable rate of loading. It can be driven from the elevator foot shaft, or by a separate motor electrically interlocked with the elevator motor. The feeder stops if the elevator stops, and can be started only after the elevator is up to speed. There are, of course, the usual overload cut-outs and under-voltage relays.

An alternative to the bucket elevator is the skip hoist with full automatic control. The skip is self-loading from a track hopper, but requires a pit about 20 ft deep. It may have a vertical or inclined path or a combination inclined-vertical-inclined run. It is suitable for higher lifts than a bucket elevator, but this factor does not enter in plant work.

The skip hoist with its structure costs less than a high bucket elevator with casing, much less than an inclined belt conveyor with bridge, and maintenance cost compares favorably with either.

Another machine for vertical lifts is the so-called *Rotor Lift*, which consists of a helicoid (screw-conveyor element) suspended within a tube or pipe casing. The device uses a head-end drive with auxiliary bottom drive to a short horizontal feeder screw. It is built with helicoids up to 12 in. diameter in capacities up to 50 ton per hr, and will



(A) High-speed, low-cost, centrifugal-discharge elevator, usually single-strand chain or belt. (B) High-speed, double-strand-chain unit. Chains snubbed back after rounding the head sprockets to give almost complete upturn, facilitating discharge of sluggish material. (C) Continuous-bucket, slow-speed single- or double-strand chains or belt. Best for large capacities. (D) Typical gravity-discharge unit. Slow speed. Combines vertical and horizontal runs

handle many of the granular and pulverized materials that can be conveyed by a horizontal screw.

As there can be no intermediate bearings between head and foot ends, maximum lift is about 45 ft. The elevator operates at about 200 rpm with a power requirement higher than for the equivalent bucket elevator. It depends on a forced feed, is not self-clearing at the end of a run, and should not be specified for a material that will freeze or spoil.

Because of the wide range of physical characteristics of materials, some may he handled nicely by bucket elevators, others are difficult, primarily because they are destructive to a chain or belt. Among these is aluminum oxide, probably the most abrasive of pulverized materials (180 to 300 mesh) with an uncanny ability to work into chain joints. It has a grinding action only slightly less abrasive than diamond dust.

Other actively abrasive materials are alum, dry ashes, bauxite, borax, cullet, flue dirt, foundry sand, glass batch, limestone dust, quartz, silica dust and sewage sludge (contains sand). Other materials with troublesome characteristics are acid phosphate, ammonium nitrate, and molybdenum concentrates that adhere to the buckets when damp.

Wet ashes are corrosive, as are some hot brewing grains having a lactic-acid content. Carbon dust intended for dry cells should not come in contact with iron or steel, unless later passed over a magnetic separator. Pelletized carbon black and soap flakes must be handled very gently to avoid damage. Rejected products mean loss in income.

Cement and other heavy pulverized materials entrain air as they enter the buckets so a wide margin of capacity must be allowed. Some finely divided clays build up in the buckets. Most of the pulverized metal dusts work into the chain and stiffen the joints.

By taking these characteristics into consideration we have a guide to the advisability of one machine over another, or to discarding an elevator in favor of a belt conveyor. Material with large heavy lumps (iron ore, crushed rock, etc.), is tough on a belt elevator, but it is easily handled by a skip hoist.

After installation, a centrifugal-discharge elevator should have a speed check. If run too slow, the discharging material will not clear the bucket ahead and falls down into the boot. This is very bad with a belt elevator where part of the discharge jams under the trailing end of the bucket ahead, bruising the belt or ripping off a bucket as it starts to ascend.

A continuous-bucket elevator should be checked to see that the load enters after the buckets line up for the ascent. If the feed is too low, material passes through the gaps and jams the boot or, with a belt elevator, jams between the buckets and belt.

A gravity-discharge elevator should be checked at the turn from the lift to the horizontal run, to see that the guide plate is properly adjusted to guide the material onto the trough, with minimum of back spill.

Regardless of the type of elevator used, the feeder speed must be checked and adjusted so the buckets fill to best percentage of loading. For capacities, power requirements and maximum size of lumps that can be handled safely, refer to Tables 1, 2, 3.

BIBLIOGRAPHY

Belt Conveyors and Belt Elevators, Hetzel & Albright, Conveyors and Related Equipment, Hudson, John Wiley & Sons Inc.

TABLE 1—VERTICAL CENTRIFUGAL-DISCHARGE ELEVATORS

Sizes of buckets; maximum lumps; capacities, buckets 75% filled.

Bucket spacing, inches	Size, length by width	Speed, feet per minute	Max. lumps all lumps	Max. lumps 10% lumps	Capacity in tons per hour 35-lb material	50-lb material	100-lb material
13	6x4	225	½	2½	5	7	14
16	8x5	230	¾	3	9	13	27
16	10x6	230	1	3½	16	23	47
18	12x7	268	1¼	4	27	38	77
18	14x7	268	1¼	4	32	46	92
19	16x8	262	1½	4½	44	63	127

Motor horsepower for centrifugal-discharge elevators closely approximates:
Tons per hour x 2 x lift in feet/1000

TABLE 2—GRAVITY-DISCHARGE ELEVATORS

(Used primarily for bituminous coal)

Capacities in tons per hour at 100 ft per min. Buckets loaded to 80% level full.

Size of bucket, inches	Capacity in tons per hour at 100 ft per min. Bucket spacing, inches			Horsepower*, with material at 50 lb per cu ft. Per 10-ft vertical lift Spacing of buckets, inches			Per 100-ft horizontal run Spacing of buckets, inches		
L x W	18	24	36	18	24	36	18	24	36
16x15	46	35	23	0.59	0.44	0.30	5.32	4.24	3.04
20x15	58	44	29	0.74	0.56	0.37	6.32	4.97	3.54
24x15	70	52	35	0.90	0.67	0.45	7.34	5.74	4.04
20x20	104	—	52	1.30	—	0.66	9.20	—	4.85
24x20	125	—	63	1.60	—	0.80	10.92	—	5.74
30x20	159	—	79	2.00	—	1.00	13.70	—	7.08
36x20	191	—	95	2.42	—	1.21	16.30	—	8.40

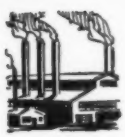
*Add 5% to horsepower for each bend in path of loaded run.

TABLE 3—CAPACITIES AND HORSEPOWER FOR SMALLER SIZES OF CONTINUOUS-BUCKET ELEVATORS

Bucket sizes; maximum lumps; capacities; hp. Capacities with buckets 75% full; speed, 125 ft per min.

Buckets Size	Gage of steel	Max. lumps All lumps	Max. lumps 10% lumps	Capacity, tons per hr 35-lb material	50-lb material	75-lb material	100-lb material	Hp required for each ft center For terminals	35-lb material	50-lb material	75-lb material	100-lb material
8x5x7 ¾	12	¾	2½	12	17	25	34	0.1	0.02	0.03	0.04	0.05
10x5x7 ¾	12	¾	2½	15	21	32	42	0.1	0.03	0.04	0.05	0.07
10x7x11 ⅝	12	1	3	19	27	41	54	0.1	0.03	0.04	0.07	0.09
12x7x11 ⅝	10	1	3	23	32	49	65	0.1	0.04	0.05	0.08	0.10
14x7x11 ⅝	10	1	3	26	38	57	76	0.1	0.04	0.06	0.09	0.12
12x8x11 ⅞	10	1¼	4	27	39	58	78	0.2	0.05	0.07	0.11	0.13
14x8x11 ⅝	10	1¼	4	32	45	68	91	0.2	0.05	0.08	0.12	0.14
16x8x11 ⅞	10	1½	4½	36	52	78	104	0.2	0.07	0.09	0.13	0.16
18x8x11 ⅞	10	1½	4½	41	58	88	117	0.2	0.08	0.11	0.14	0.18

Note: The largest standard continuous-bucket elevators operate at 100 fpm, can handle material with some lumps up to 10 in. and have buckets up to 36 x 17 x 23½ in. for which size the rated capacities for various weights of materials are: 50 lb—340 tons per hr; 75 lb—500 tph; 100 lb—700 tph.



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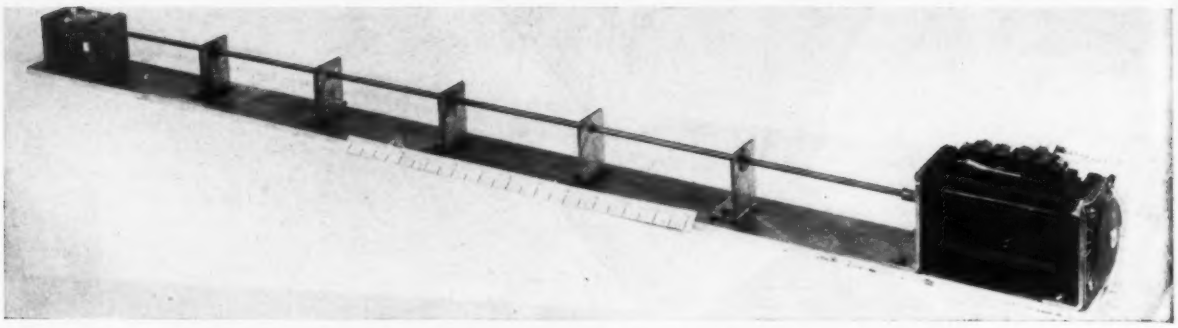


Fig. 1—Experimental setup uses clutch at left to stop rotation, causing rotor momentum to twist shaft. Rebound brings motor (right) to speed in opposite direction. Once started, rotation is maintained by continuous, single-phase power

QUICK REVERSAL OF ELECTRIC MOTORS

A METHOD for reversing small motors in three to four milliseconds has been developed by Jacob Rabinow at the National Bureau of Standards. Designed specifically to meet the need for high-speed reversal of magnetic tapes in the memories of electronic digital computing machines, the technique may prove useful in many other applications.

It is relatively easy to stop a motor quickly with brakes, but rapid starts are limited by the low torques, which can be obtained by electromagnetic means alone. In the Bureau's rapid-reversal motor, the kinetic energy of the rotor, instead of being dissipated as heat in a brake during deceleration, is converted into potential energy in a spring. The spring's energy then accelerates the rotor rapidly in the opposite direction.

To carry out the tests, a small, low-inertia, 2-phase 3200-rpm motor was operated on single phase so that it would rotate in the direction in which it was started. The reversal spring consists of a steel torsion bar, Fig. 1, approximately 31 in. long and 3/16 in. in diameter. The motor shaft is rigidly connected to the right end of the bar, which is equipped at the left end with two positive, unidirectional clutches, Fig. 2. One clutch prevents clockwise, and the other counter-clockwise rotation.

If the motor is rotating and the housing is shifted to engage the proper clutch, the end of the torsion bar is stopped; bringing the rotor to rest in approximately 20 degrees twist of the torsion bar. Potential energy stored in the bar is then returned to the rotor as rebound, restarting it in the opposite direction. The motor attains virtually full speed from the impulse in the new direction within about two milliseconds, and continues rotation on the single-phase power.

To check the reversing time of the motor, a black disk provided with a white index line was mounted on the right end of the motor shaft, Fig. 1, and photographed against a circular scale, using a high-speed motion-picture camera at about 4,000 frames per second. When the film is run through a projector at the normal rate of 16 frames per second, the behavior of the disk is easily observed. In Fig. 3, the index mark was opposite the 70-degree mark on the motor-frame scale when the clutch engaged in the 15th film frame, shown by change in curve slope.

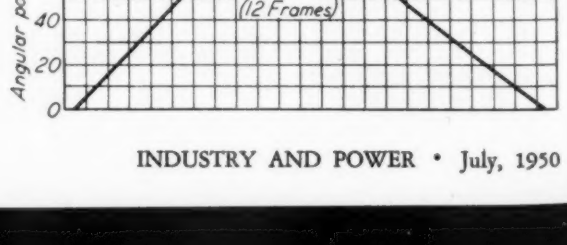
Six frames later, the rotor had stopped at 87 degrees, and in another six had recovered its speed in the opposite direction. When the motor is rapidly reversed, the backward speed is, for a short time, slightly lower than the speed before reversal because the ball-bearing assembly does not reverse its rotation as rapidly as does the motor shaft. Twelve frames at 4,000 per second equals 3 milli-seconds reversing time for the rotor.

In the experimental model the clutches are operated manually, but they can be arranged to be operated by suitable electromagnetic controls. It is anticipated that motors of all sizes could be reversed rapidly by this technique, the speed of reversal being limited only by the mechanical strength of the various parts. Moreover, with proper circuit design, rapid reversal of motors can be obtained without producing large current surges in the electrical supply lines.

It is entirely feasible to utilize other types of energy-storing devices, such as coil springs or pneumatic cylinders, instead of the torsion shaft. It is also possible to use a stationary energy-storing system, locating the reversing clutches between it and the motor shaft.

Fig. 2—Double, unidirectional clutch clamps shaft end for either direction of rotation when housing is shifted

Fig. 3—During reversal, high-speed movie frames show rotor position on the circular scale on motor frame



HOW TO CLEAN FUEL TANKS

Each year, users of oil should clean the tanks. Lionel S. Marks tells why the proper solvent simplifies the work and saves money

With good weather ahead and the heating part of their steam load behind them, commercial and industrial boiler plant operators will be thinking again about the tank cleaning problem. Every year, a proportion of the users of heavy fuel oil face this problem, until at some time or other, a good solution appears.

The residue or sludge that collects in the bottom of fuel oil tanks is a mixture of resinous hydrocarbon derivatives; water, dust, rust and scale. It collects to some extent with all fuel oils, but mostly with No. 5, No. 6 and bunker oils. It is most troublesome with these oils because of their higher viscosity. The amount collected will vary considerably depending on: (a) crude base of the oil, (b) refinery operations, (c) condition of supplier's tanks and equipment and (d) amount of moisture condensed inside tanks and falling through the oil to the bottom.

Attempts have been made to deal with this residue by adding various substances to the fuel oil in the tank. Some emulsifiers have been reasonably successful in removing deposits, but they necessitate shutting down some part of the equipment, and they make all residues so removed unburnable.

The ideal additive would be one that would work without interrupting plant operation, that would be heavier than the fuel oil and sink through to the residue below and penetrate it, and that would be non-corrosive and non-toxic.

The problem in the past has been that the residuals have been "catch-alls" for almost everything that was off specifications in the higher grade fractions, including plant spills and even acid and alkali wash residues. Today, with more and more refineries going to catalytic cracking and no one being sure when any batch of residual might be needed for charging stock, there will be more discrimination in the dumping of off-grade products.

Hence, it may be easier to develop a solvent that will keep the contents of the tank, from top to bottom, in a burnable condition. This may account for the fact that, in the last few years, there have been many more reports of the successful use of solvents now on the market.

Certainly every effort should be made to develop effective solvents, and engineers in oil-fired steam plants should be ready to test additives offered by reputable concerns.

As against manual removal of tank residues, the solvent would have many important advantages, such as:

(A) The sludge may be burned and hence be productive of heat instead of being removed and dumped.

(B) Increased day by day efficiency resulting from continuous operation with clean nozzles or burner tips, filters, heat exchangers and strainers.

(C) Less concern with oil meeting specifications, or perhaps broader specifications permitting lower priced oil to be used.

(D) The "curse" of one tank installations would be removed.

(E) The expense of cleaning tanks, which would be many times the cost of any solvent, would be eliminated.

(F) Less wear on pumps and generally less maintenance and possibly lower labor cost for firing.

(G) Less damage to refractory furnace linings.

The subject is of prime importance. There is no need to be in doubt about any particular solvent—simple tests can be made that will afford the necessary information. Some tests that would provide sufficiently accurate information are:

1. By mixing samples of sludge from the operator's own tank with varying amounts of solvent, determine if the solvent actually will dissolve it. How fast, and with what proportion of solvent to residue. Remember, tests must be made under identical conditions with the plant operation; for instance, mixtures of sludge and solvent can be shaken in a test tube, not in a tank.

2. Test (a) sample of solvent and (b) sample of solvent and sludge for firing qualities. Ascertain flash and fire points of both samples, these are standard tests.

3. Determine if the solvent will pass down through the fuel oil and penetrate sludge at the bottom. This could be done by taking two similar flasks with bottom outlets, filling one with fuel oil and sludge, and the other with fuel oil, sludge and solvent in the proportion determined in the first test. Let these samples stand for 24 hours, and then compare samples of each run off from the bottom of the flasks.

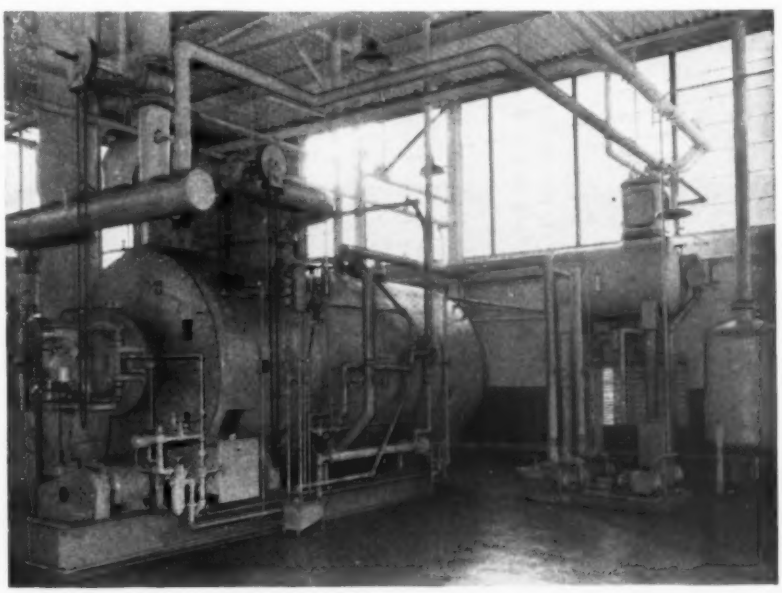
4. Immerse steel and copper strips in the solvent and leave for 24 hours to determine amount of corrosion.

5. Make pH tests to determine neutrality of solvent.

6. Ascertain viscosity of solvent and mixture of solvent and fuel oil.

If the plant operator does not have facilities for making these tests, there are testing laboratories that will do so at a nominal charge.

It is well to keep in mind that it is easier and less expensive to keep tanks clean than to clean out old sludge.



CLEAN FUEL *tanks mean fewer unsightly floor stains around oil strainer boxes*

Spot News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Ammonia Refrigeration System Used For Heating And Cooling

Nerve center of this expanded plant of Minute Maid Corp. is a reciprocating type refrigeration system. This maker of frozen orange juice removes water from juice at a low temperature by reducing the pressure within the concentrator. This reduces the boiling point. The temperature in process never exceeds 75 F, and when the pressure approaches 10 mm, the temperature is about 60 F.

Juice is introduced into specially designed evaporators, which liberate the water content. Warm water from an ammonia condenser is used as the heating medium for the first effect evaporator. The condensing water is returned to the refrigerant system and mixed with water from a cooling tower to effect a constant temperature available to the first effect evaporator at all times.

Vapor liberated in the first effect, after leaving a separator, becomes the heating medium for the second effect evaporator. The water vapor from the final effect after leaving its separator is condensed in an ammonia evaporator.

A specially designed Worthington 46 in. x 16 ft-0 in. ammonia evaporator is used to condense the liberated vapors from the single strength orange juice. This vessel is designed with a 42 in. x 8 ft-0 in. surge drum with float controls.

Low temperature ammonia is returned to the suction side of a 12 in. x 14 in. horizontal duplex ammonia compressor complete with 400-hp synchronous motor. High-pressure ammonia gas is condensed and stored in a 38 in. x 20 ft receiver.

Orange concentrate drawn from the final effect evaporation is pumped to a blending and mxing system where the concentrate is blended with a predetermined portion of single strength orange juice.

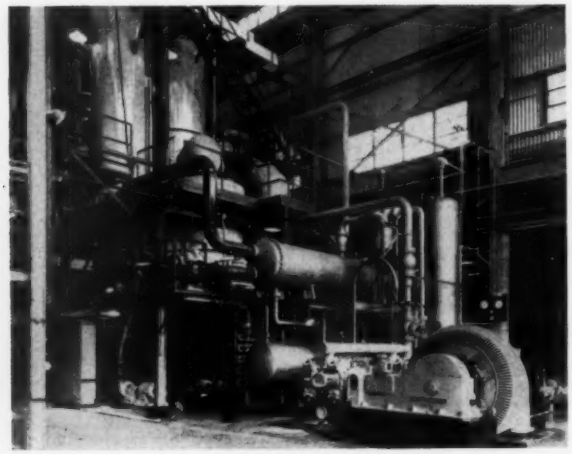
100 Million Electron Volt Betatron for Research

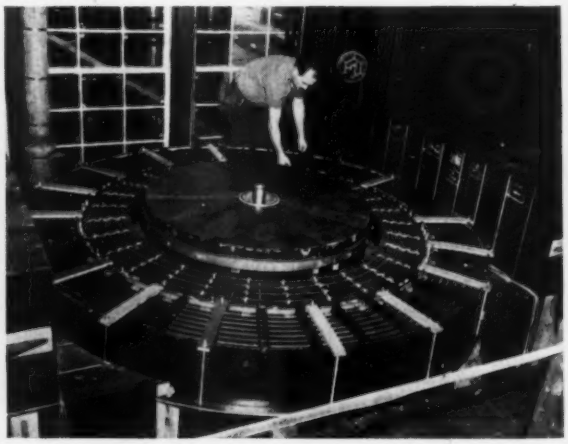
Largest and most powerful, commercially available particle accelerator is now installed and being tested at the University of Chicago. The first complete unit of its type ever sold by G. E., the new 100,000,000 electron volt giant will be used for nuclear research at the University's Institute for Nuclear Studies.

Engineered by the G. E. General Engineering and Consulting Laboratory, the betatron includes a 160-ton magnet, a 24,000-kva capacitor bank, power and electronic cubicles, and a control consol. The magnet, made in the Pittsfield Works in Massachusetts, was shipped in sections, the largest weighing 35 tons.

The betatron might be compared to an ordinary transformer. Instead of the secondary coil, a doughnut-shaped vacuum tube is placed within the magnetic field. Sealed to the doughnut is an electron gun from which electrons are shot tangentially into the doughnut and acted upon by the magnetic field, causing them to travel around the tube. The voltage increases on each revolution as though they were flowing through a single turn of wire.

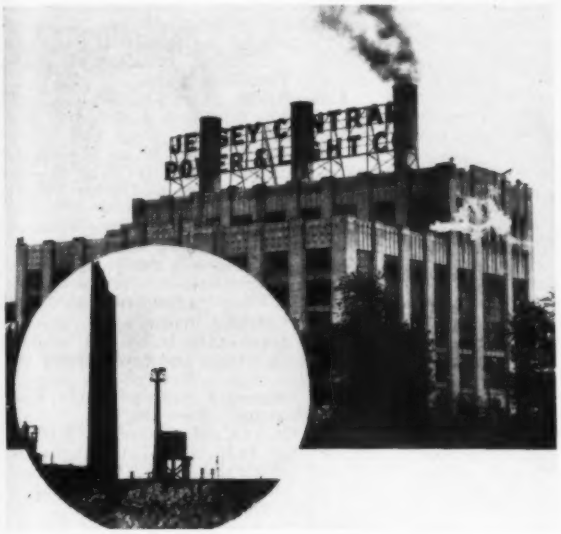
After some 25,000 revolutions, the electrons reach the rated energy level and are magnetically guided from the tube to strike a target, producing X-rays. The wave-length is determined by the energy of the bombarding electrons, a hundred times that of conventional X-ray machines.





Damage from Explosions Can Be Reduced With Proper Equipment

Recently almost 500 tons of munitions blew up in Raritan Bay, South Amboy, New Jersey. Just 400 yards away, the 56,000-kw plant of the Jersey Central Power and Light Co. took the full concussion from the blast. Because of the plant's proximity to the point of explosion, concern was felt for the stacks exposed to the full force of the concussion. There seemed little hope that they would survive and be in condition to service the boilers. The steel stacks and sturdy brick building came through intact, except for a few blown out windows. Inset is that of a nearby plant,



approximately the same distance from the blast area, rendered inoperative for weeks due to a demolished chimney.

John E. Casey, chief engineer states in his report: "There occurred no damage to our generators, but considerable damage to our controls. Our stacks remained intact and functioned without interruption, despite the fact that the blast was a terrific one. Immediately after the blast, the power load was transferred to other of the company's plants and sources in the Eastern Power Network.

During the explosion, eighteen shells landed on the roof of this plant and three in the boiler room. One shell, landing on top a boiler, later exploded. In spite of this danger, an emergency crew took over and three days later one generator was in operation with another two days following.

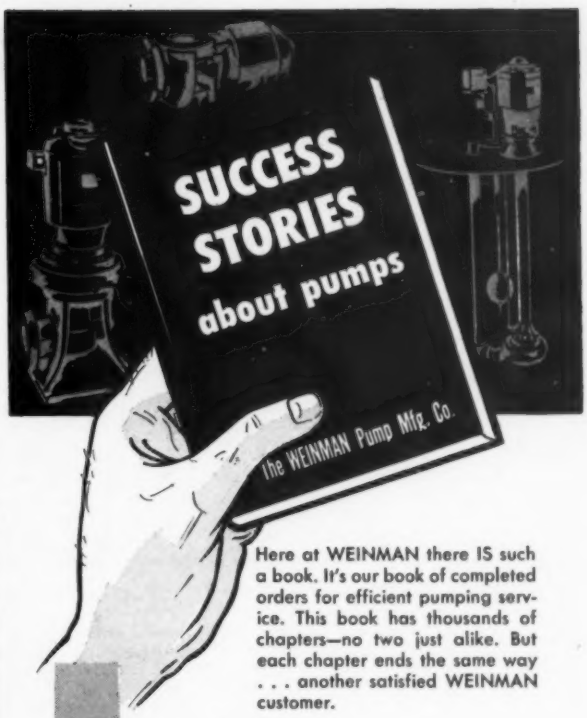
Prat-Daniel is proud of the fact their fan stacks have weathered many catastrophies such as this, coming through hurricanes, tornados and explosions unscathed.

Communication Again Leads Industrial Field In Safety

Industrial injury rates for last year, released by the National Safety Council in advance of the 1950 edition of its annual statistical yearbook, "Accident Facts," show a substantial reduction in both the frequency and severity of 1949 accidents as compared with 1948. Thirty-eight of the 40 basic industry classifications reduced their frequency rates, and 28 reduced their severity rates.

Accident frequency rate for employes in all industries submitting company reports to the Council, based on the

(Continued on page 136)



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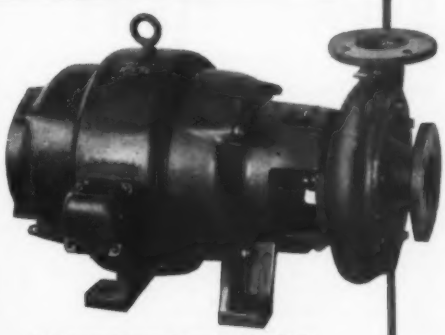

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MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

National Power Show and ASME Meeting—The 19th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, November 27th to December 2nd under the auspices of the ASME in conjunction with the Society's annual meeting. The 1950 exposition will be the first to be held under the auspices of the ASME.

Interest in the Power Show this year is heightened by the fact that many owners and executives throughout the country are planning to modernize their power plants. This is taking place on a huge scale in a wide range of industries. Almost three hundred manufacturers to date have engaged exhibit space on the three lower floors of Grand Central Palace.

One obvious advantage of the Power Exposition is that thousands of visitors from greatly diversified industries are able to inspect the products of several hundred exhibitors and to see numerous demonstrations all under one roof within a period of six days.

Complete information may be secured from the Exposition at Grand Central Palace, New York 17, N. Y. Charles F. Roth, president of International Exposition Company is manager of the exposition. E. K. Stevens is associate manager.

Instrument Society of America—Houston Section of the Instrument Society of America has announced that the Instrument Conference and National Exhibit will be held September 10-14 at the Coliseum in Houston, Texas. W. H. Fortney, Chairman of the Committee will handle arrangements. Mr. Fortney is the instrument foreman at the Humble Oil & Refining Company's Baytown refinery.

This will be the first National ISA meeting held west of the Mississippi River. Attendance at past Meetings has included industrial leaders from all over the world. It is expected that this will be the largest technical conference and exhibit ever held in Houston.

The following societies are cooperating in the Convention plans: The Industrial Instruments and Regulators Div. of ASME, American Institute of Physics, Instruments and Measurements Committee of the AIEE, Institute of Radio Engineers, National Telemetering Forum, and Scientific Apparatus Makers Association.

National Instrument Conference — Fifth National Instrument Conference and Exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18-22, 1950. It will include technical sessions of the following participating societies: The Instrument Society of America, American Institute of Physics, Industrial and Regulators Division of the ASME, Institute of Radio Engineers, Instruments and Measurements Committee of the AIEE, and National Telemetering Forum.

The instrument exhibit will occupy 15,500 sq ft and will include scientific and industrial instruments and devices for measurement, inspection, testing and automatic control.

National Power Show—The 49th annual National Power Show sponsored by the National Association of Power Engineers will be held in Hotel Jefferson, St. Louis, Mo., August 15-19, 1950. It will run in conjunction with the 67th NAPE annual convention. John C. Toohy, 176 W. Adams St., Chicago, is exhibit manager.

Features of the 1950 show will be an extensive industrial film program, and round table clinics at which each exhibitor may discuss his problems or ideas. Exhibits will include all types of equipment and accessories for steam and power generation; steam and electrical distribution; power transmission; heating and ventilating; refrigeration; air-conditioning and materials-handling.

Idustrial Relations—Five intensive full-time conferences on specialized aspects of personnel administration and industrial relations will be conducted next month by the Industrial Relations Section, California Institute of Technology, Pasadena, Calif.

Conferences scheduled are: July 9 to 14—Re-examining a pension program; July 9 to 14—wage and salary administration; July 16 to 21—managerial development; July 16 to 21—re-examining insurance and other benefit programs (other than pensions); and July 23 to 28—communication between management and employees.

Each conference is designed for executives responsible for company development and administration, and problems of this nature will be discussed. Attendance is limited to permit full discussion and exchange of experiences.

The conference leaders include: Lee Laird, manager, Benefits Div., Standard Oil Co. of Calif.; Russell L. Moberly, director, Industrial Management Institute, University of Wisconsin; Paul Pigors, associate professor of Industrial Relations, Massachusetts Institute of Technology; John W. Riegel, director, Bureau of Industrial Relations, University of Michigan; Leo Wolman, professor of economics Columbia University; and Robert D. Gray, director, Industrial Relations Section, California Institute of Technology.

BOOK REVIEWS . . . . *Here are the latest books from the publishers lists reviewed for your convenience in selecting the ones that will meet your needs in a variety of engineering, plant equipment and related subjects*

Handbook

"Kents Mechanical Engineers Handbook," "Power Volume," by J. Kenneth Salisbury and "Design and Production," by Colin Carmichael. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Two volumes. 3,000 pages. Illustrated. $8.50 each.

Two separate volumes, each written by a large staff of experts, accurately reflect the developments in mechanical engineering that have been made since the eleventh edition was published in 1936.

Retaining the handy size and flexible binding of the previous edition, the new handbook has been completely rewritten in clear and accurate language. Practice is stressed rather than theory. All the text and illustrative material that has made "Kent" a dependable source of data for thousands of engineers in earlier editions has been recompiled from the most thoroughly verified sources.

Although much of the material from the eleventh edition has been condensed, both volumes are now larger than predecessors in order to present the most recent data and the latest practice. A carefully worked out index makes each piece of information doubly accessible. One hundred and sixty-eight specialists, all well known in their respective fields, have contributed to the new "Kent."

1950 Guide

"Heating Ventilating Air Conditioning Guide," 1950 edition. Published by The American Society of Heating and Ventilating Engineers, 51 Madison Avenue, New York 10, N. Y. Illustrated. 1420 pages. Blue cloth binding, $7.50.

This new edition contains a storehouse of technical and practical engineering information pertaining to heating, ventilating, and air conditioning. Over 50 chapters of engineering data are offered. All text matter has been revised and 44 pages, on new subject matter, have been added.

General subject heads in the table of contents are as follows: Section I, Fundamentals; Section II, Human Reactions; Section III, Heating and Cooling Loads; Section IV, Combustion and Consumption of Fuels, Section V, Systems and Equipment; Section VI, Special Systems; Section VII, Instruments and Codes; and Catalog Data Section.

Machinery Foundations

"ESC Bibliography No. 5," published by engineering Societies Library, 29 West 39th Street, New York 18, N. Y. $2.00.

This biblography is a list of 120 annotated references to selected books and periodical articles published from

1924 to 1949 on the theory, design and construction of machinery foundations. The references also cover specific problems such as heavy machinery foundations on unstable soils, and the vibration problems related to foundations of hammers, oil engines, electrical machinery, turbines, steam engines, compressors, machine tools, etc.

Air Conditioning Load Sheet

"Cooling and Heating Load Estimate Sheet." Published by The Trane Co., La Crosse, Wisconsin. Form 389-A. Pads of 50, 50c—in lots of 12 pads or more, 35c; pads of 25, 25c—in lots of 12 or more, 20c.

Compact cooling and heating-load estimate sheet is the latest addition to the service and educational materials made available to engineers, contractors, and architects by this company. Sheets are printed on 8½ in. x 11 in., 9-lb transparent bond to conserve file space, and to permit ready blueprint and black line reproduction.

Due to careful editing and layout, the new compact sheet contains spaces for more items than those contained in the previous 11 in. x 17 in. sheets widely used for air-conditioning calculations. Included for the first time is space for heating calculation.

In keeping with Trane's educational policy, the new cooling and heating load estimate sheets will be made available to the trade on a non-profit basis.

Plant Layout

"Plant Layout and Materials Handling," by James M. Apple. Published by The Ronald Press Co., 15 East 26th Street, New York 10, N. Y. Illustrated. 367 pages. $5.00.

This book is the latest word for engineers, production managers, and resourceful technicians who want effective solutions to the problems of coordinating plant layout, materials handling, methods engineering, and production planning and control.

Based on the author's many years of experience in close association with numerous industries, the book offers scores of ideas and techniques plus numerous illustrations showing how new, effective combination of men and equipment have proved successful in solving plant layout problems. He outlines the pattern by which many steps in plant layout can be systematically brought together, with the assurance that no necessary step will be omitted in investigation, and with aid in carrying out the procedure for developing best solution to a specific problem.

Engineers As Managers

"The Engineer as a Manager," prepared by Dr. J. M. Juran. Published by the Bureau of Public Information, New York University College of Engineering, New York 53, N. Y. Four-page folder, 10 cents.

Text covers the following subjects: Relationship of Management to Engineering; Case History of an Engineer Who Became a Manager; Does Study of Engineering Qualify One to Become a Manager; What Must an Engineer Do to Become a Manager; Should the Definition of Engineering be Opened Up to Include Management; and Training Engineers in Management.

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NEWS . . . of men and companies

The National Supply Co.—Superior Engine Div., has announced the opening of a new regional office at Kansas City, Mo., and the appointment of R. C. Straube as regional manager, to head that office, according to Robert M. Pearson, manager of sales.

R. C. Straube

D. J. Gemmell

Cleveland Chain & Mfg. Co.—Election of David J. Gemmell as executive vice president was announced recently by Raymond L. Round, president and chairman of the board.

Mr. Gemmell, one of the most widely known executives in the chain industry, has been associated with Cleveland Chain since 1929. Recently, he was named chairman of the executive committee of The Round Chain & Mfg. Co., Chicago, an affiliate of Cleveland Chain. In his new post, he will continue to direct Cleveland Chain's national sales program and will assume important new duties in conjunction with over-all company policy.

Palm & Patterson, Inc.—National Malleable and Steel Castings Co. announces the appointment of Palm & Patterson, Inc., to handle advertising and sales promotion. Business and trade magazines, direct mail and catalogs will be used. T. King-Hedinger, agency vice president, will supervise the account.

Originally established in 1868, National Malleable and Steel Castings Company is one of the nation's largest producers of malleable castings.

Yale & Towne Mfg. Co.—The board of directors elected Elmer F. Twyman of Chicago as vice president in charge of the Philadelphia Div., to succeed James C. Morgan on June 15th when he retires, it was announced by Gilbert W. Chapman, president. The Philadelphia Div. manufactures and distributes the Yale line of hoists, industrial trucks, scales, and other materials handling equipment.

John A. Baldinger, who is assistant general manager of the Automatic Transportation Co. Div., will be transferred by Mr. Twyman to the Philadelphia Div., when he will become assistant general manager at the Philadelphia plant.

The appointment of Lawrence J. Kline as general Manager of the Automatic Transportation Co. Div., Chicago, was announced by Mr. Chapman. Mr. Kline succeeds Mr. Twyman.

Combustion Control Corp.—Stanley J. Pachyn joins the organization as assistant sales manager with headquarters at the Chicago office. Rody G. Capron becomes west coast sales manager with headquarters in San Francisco. Mr. Capron has been associated with the oil burner industry for the past fifteen years. Dana Fisher moves from the Cambridge sales office to the New York sales office.

Elliott Co.—M. A. King, engineering vice president, has recently been named a Fellow of the ASME.

This honorary appointment is conferred only upon engineers with acknowledged engineering attainment and at least 25 years of active practice. The grade has been given Mr. King in recognition of his achievements in turbine design. His principal contribution has been on standard commercial lines of turbines, which incorporated practices previously limited to specially constructed and individual machines.

M. A. King

R. W. Kerr

Bingham-Herbrand Corp.—The board of directors has elected Robert W. Kerr as president and chief executive officer. Mr. Kerr joined the organization in 1948 as vice president and general manager of the Herbrand Div.

The following announcements were made: Edward E. Parsons, Jr. elected chairman of the board; David R. Feemster, vice-president, made general manager of the Bingham Stamping Div.; Louis E. Yunker, retiring president, will continue on the board of directors; and Roland J. Ahern has been elected to the board.

Jerguson Gage & Valve Co.—Merchandising and servicing on a worldwide basis is a result of expansion steps recently taken in forming an English company in collaboration with the Tress Engineering Company. The English company, Jerguson Tress Gage & Valve Co., Ltd., has headquarters at Africa House, London, England, and uses the manufacturing facilities of Tress Engineering Co., who are well known as manufacturers of globe valves and gate valves for the petrochemical industry.

Officers and directors of the new company are Cecil W. B. Tress, chairman; E. Sheard, chief engineer; and W. Birks Creasser, sales manager, with headquarters at London; and Brooks Stevens, Jr., E. E. van Ham, N. Garfield, and James A. Ford, with headquarters at Somerville, Mass.

I-T-E Circuit Breaker Co.—A separate small circuit breaker division has been formed. The action was taken, the company said, "in view of the increasing importance of the small circuit breaker field. By separating this activity, I-T-E will be able to afford a more flexible and complete service to its customers."

Tube Turns, Inc.—John G. Seiler, executive vice president and general sales manager, has announced the appointment of J. T. Wing & Co. of Windsor, Ontario, as a distributor of Tube-Turn welding fittings and flanges. The Canadian organization, which has a branch in Chatham, Ontario, will represent both Tube Turns, Inc., and its subsidiary, Tube Turns of Canada, Ltd.

The Babcock & Wilcox Tube Co.—Isaac Harter, board chairman, has been named a Fellow of the ASME, it was made public recently. The grade of Fellow, conferred upon engineers with at least 25 years of active practice or teaching experience in a school of accepted standing, with acknowledged engineering attainment, is an honor held by less than one per cent of the ASME membership.

During his long association with The Babcock & Wilcox Co. Mr. Harter made many significant contributions to industrial progress. One of the most far reaching was his work in conducting experiments leading to the discovery that chemical action of water in boilers under pressure was causing "caustic embrittlement" resulting in cracking of expensive boiler drums. Proper treatment of feed water then eliminated the hazard.

Allis-Chalmers Mfg. Co.—Announcement has been made of the appointment of three new district office managers, effective July 1, for the general machinery division. They are J. H. Burrus, manager of the Milwaukee district; U. E. Sandelin, Portland district, and Stephen C. Bacon, Seattle district. Burrus, since 1949 manager of the Portland district, succeeds H. A. Balding, who is retiring from active management of the Milwaukee district after being associated with Allis-Chalmers since 1902.

Yarnall-Waring Co.—The following appointments in the Yarway sales organization have been made: Lytton C. Musselman in charge of Los Angeles district at company office in Huntington Park, Calif.; Power Engineering Co. as general sales representative in Salt Lake City; Wallace J. Agren as sales engineer in Chicago branch, replacing F. C. Harry Vaughan, deceased; R. W. Westlake as sales engineer in Cleveland branch; Andrew M. Ritter, district manager of Detroit branch, replacing Charles H. Grosjean

who is returning to the New York territory. Lyle G. Chase, Jr. has joined the sales engineering staff of the New York district office.

Dearborn Chemical Co.—W. A. Lutsch is now the manager of branch office operations in Detroit and the state of Michigan. Mr. Lutsch, who has been with Dearborn since 1936, will make his headquarters in Detroit.

Bituminous Coal Institute—Ralph C. Mulligan, director of public relations of the Bituminous Coal Institute, a department of National Coal Assoc., has announced the appointment of H. B. Brown, Jr. to the BCI public relations staff. Mr. Brown—an experienced writer and publicist—comes to the Institute from Whitaker & Baxter, a Chicago public relations firm. Before the war, Mr. Brown was editor of a weekly newspaper in Uniontown, Pa. He then served the Lord & Thomas advertising agency as copy research assistant, and for three years was an associate editor of Pic magazine. He served in the Navy as personnel officer in the Canal Zone and then became public relations officer for the Naval Ordnance laboratory in this city.

Midwest Piping & Supply Co., Inc.—Guy L. Morrill was elected to the board of directors at the company's annual stockholder meeting here today. Manager of the Company's Pacific Div., he succeeds W. G. Hooper of St. Louis, deceased, as director. All other directors and officers of the company were re-elected.

Nordberg Mfg. Co.—James A. Friend is now the senior vice president according to Robert E. Friend, president. James Friend, former vice president and general purchasing agent, will take over the duties of F. Howard Kilberry, who resigned. Floyd T. Finley succeeds Mr. Friend as general purchasing agent.

Other activities include: D. A. Cheyette, vice president of the Crusher Div. elected to the board of directors, and Arthur W. Mueller was appointed assistant controller.

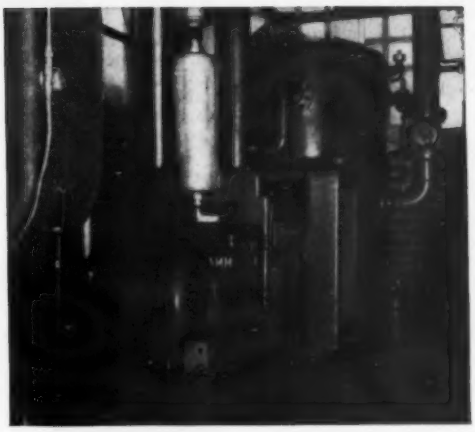
J. A. Friend

H. R. Comstock

Goodyear Tire and Rubber Co.—H. R. Comstock has been appointed manager of the central div. the company's mechanical goods sales, replacing H. E. Langdon, whose new duties have not been assigned.

Other organizational changes in the mechanical goods sales div. were also announced by H. D. Foster, manager of the division. R. C. Stein has been promoted to manager of molded goods

Unistage COMPRESSORS



Model 105 Schramm *Unistage* V-Belt Driven Compressor installation in a large industrial plant. Automatic belt tightener which tightens belts in proportion to load, optional equipment at slight additional cost.

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SCHRAMM INC. offers a complete line of Industrial Compressors in sizes ranging from ... 2 to 600 cubic feet displacement... Built and designed for continuous heavy duty service with a minimum of attention.

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Easy Accessibility
Vibrationless
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sales at the St. Marys' O., plant. R. E. Chapman was appointed manager of hose sales, Akron, succeeding R. W. Sanborn, who is now representing the mechanical goods div. in Akron.

Hall Laboratories, Inc.—Dr. Everett P. Partridge, director of research has been named director of Hall Laboratories, Inc. Internationally known for his research studies in the field of chemical reactions of boiler water with steel, he is a leading authority on application of the molecularly dehydrated phosphates.

Dr. Partridge has pioneered in the field of industrial water-conditioning. This includes the conditioning of water for cooling functions, the softening of water by sequestration, and water-conditioning for a variety of specific applications in chemical and process industries.

He has been closely associated with Dr. Ralph E. Hall, whom he succeeds as director. Dr. Hall is continuing as a member of the board of directors and in a consulting capacity.

Charles E. Kaufman, assistant director of research has been named director of research to succeed Dr. Partridge. Mr. Kaufman joined the company as a research engineer in 1936 after his graduation at the University of Cincinnati. He became a research group head in 1941, and assistant director of research in January, 1949. He received the master of science degree in chemistry at the Carnegie Institute of Technology in 1942.

Dr. Thomas H. Daugherty, assistant director of research, has been named director of research to replace Dr. Partridge. D. J. Erikson, Hagan president, announced that Dr. Daugherty will be in immediate charge of research and development work in the application of "Calgon," a sodium phosphate glass, and other products of the company in various uses.

John N. Welsh, director of engineering service since 1939, has been named associate director of the firm. He will continue as director of engineering service.

Mr. Welsh joined Hall Laboratories as a service engineer in 1929. For the past eleven years he has headed the service engineers, handled special service problems and the application of research to operation.

Mr. Welsh has authored several well-known technical papers in the field of boiler water conditioning, including studies of the reduction of boiler sludge with silicates, and application of boiler water-conditioning knowledge and techniques from the viewpoint of the operator. One of his specialized fields is corrosion of metals by condensed steam.

United States Steel Corp.—Gordon L. Edwards, vice president and treasurer, will retire this month after more than 50 years of service with the company and one of its predecessor companies, the National Tube Co.

Max D. Howell, assistant to president, vice-president, secretary and treasurer of United States Steel Corp. of Delaware, has been elected vice-president and treasurer of United States Steel Corp. of New Jersey, it was announced by Irving S. Olds, chairman of the board.

United States Steel Products Co., U. S. Steel subsidiary, announced the appointment of George P. Wardley, Jr., as sales manager in the St. Louis district. He succeeds Thomas M. Stinson, who has been promoted to be general sales manager of the company with headquarters in New York.

Thomas A. Edison, Inc.—Charles Edison, president for the past 24 years, was elected to the newly created position of chairman of the board of directors, and Henry G. Riter, 3rd, was elected to succeed Mr. Edison as president. Mr. Edison, formerly governor of New Jersey and Secretary of the Navy, succeeded his father, the late Thomas A. Edison, founder of the company, as president of the Edison Industries in 1926. The company had not had a chairman of the board of directors since the death of Thomas A. Edison in 1931.

Mr. Riter has been a director of the company since 1946, and chairman of the executive committee since January, 1949. Mr. Riter is senior partner of Riter and Co., New York investment banking firm and chairman of the board of the Copperweld Steel Co.

Charles Edison

A. S. Neblett

General Electric Co.—Effective July 1, Robert S. Neblett will assume the position of assistant manager of sales, turbine div., of the apparatus dept., it has been announced by C. S. Coggeshall, sales manager.

L. D. Whitescarver has been appointed assistant manager of the Lynn (Mass.) turbine and gear sales div. Succeeding him as manager of the Fitchburg (Mass.) turbine sales div. is F.S. Kohl, formerly assistant manager of that division.

Four new appointments in the apparatus dept. Atlantic district have been made by S. Littlejohn, district manager. These include: F. L. Headley as assistant manager of the Pittsburgh apparatus sales office, who will later replace the present office manager, Joseph Bryan, upon his retirement; N. L. Whitecotton as manager of the Philadelphia apparatus sales office, succeeding Headley in that position; F. I. Kittredge as manager of the Philadelphia apparatus sales office's industrial customer div.; and W. C. Mason as Atlantic district manager of the agency and resale div., with headquarters at Philadelphia.

Westinghouse Electric Corp. — Vice president W. O. Lippman, formerly in charge of plant labor relations, becomes head of the Westinghouse elevator div. at Jersey City, N. J. In the exchange, vice president Tom Turner comes from the elevator div. to take charge of plant labor relations with headquarters in Pittsburgh. The announcement was made by L. E. Osborne, vice president in charge of manufacturing, the result of a move to keep current manufacturing experience in the labor relations department.

Babcock & Wilcox Tube Co.—Plans to enter the field of limited fabrication of seamless and welded tubing, in addition to its primary work on manufacturing such tubing, were announced here today. The types of fabrication to be handled under the new policy, E. A. Livingstone, vice president, said, will include bending; end forming such as swaging, upsetting, flaring and expanding; flash-butt-welding for safe-ending and making long-length tubing; the production of tubing with various cross section shapes and other specialty tube.

Detroit Stoker Co.—An announcement was made by the head office and works at Monroe Mich., of the promotion of Herbert L. Wagner to vice-president in charge of engineering. Mr. Wagner will continue to be located at the Detroit office of the company, where for some time he has had the title of chief engineer, following the retirement of Royce L. Beers, former vice president in charge of engineering, who is still associated with the company's activities as a director.

Worthington Pump and Machinery Corp.—H. C. Ramsey, president, announced recently that Charles A. Butcher has joined the organization June 1st as assistant to the president. Mr. Butcher formerly was general manager of Crocker-Wheeler Electric Mfg. Co., and vice president of its successive parent companies, Joshua Hendy Corp. and Elliott Co. He will make his headquarters at New York.

The American Pulley Co.—In a further step to extend its field organization, the appointment of Gerard P. Weishaar as eastern regional manager is announced. In this new capacity, his operations will parallel those of Randolph Jackson, who is mid-west regional manager, with headquarters at Chicago.

Mr. Weishaar will have direct charge of district managers and representatives in the New England, Rochester, New York, Philadelphia, Charlotte, and Atlanta territories. The appointment of John T. Barron as manager of its power transmission division is also announced. Mr. Barron's activities will be centered on the product and market development of American flat belt, v-belt, and speed reduction drives and other types of mechanical power-transmission.

Diamond Power Specialty Corp.—Willis P. Thomas, president, announces the appointment of Lyle B. Schueler as sales manager. He has been active in the development of many outstanding features in power plant design elements and is thoroughly familiar with all phases of equipment function, design, and application. He has also been serving on numerous technical committees of engineering societies and organizations.

Goodyear Tire & Rubber Co.—Three additions to the staff of the chemical div. have been announced by H. R. Thies, div. manager. William E. Kelly, in sales training within the division for more than a year, has been assigned to the New York district offices; J. E.

Warner, also completing the training course, is now in the Chicago district office; and David M. Clark has been assigned to the Akron staff. All three have had extensive chemical training.

American Society of Lubrication Engineers—Carl E. Schmitz, vice president and director of engineering, Crane Packing Co., was elected vice president-at-large of the ASLE at the annual convention just concluded in Detroit.

Mr. Schmitz was previously treasurer and regional vice president of the organization. His other current activities include chairmanship of a sub-committee on engine design for the SAE and membership on the conference committee of the National Conference on Industrial Hydraulics.

Quaker Rubber Co.—J. R. Keach has been appointed general manager of the corporation, a division of H. K. Porter Co., Inc. During his 25 years in rubber, he has been purchasing agent for The Ohio Rubber Co., general plant manager for Firestone Industrial Products Co., and directional sales manager for the Hamilton Rubber Corp.

Cooper-Bessemer Corp.—Ralph L. Boyer and William E. Stevenson have been elected to the board of directors.

Mr. Boyer started his design career with Cooper-Bessemer in 1926 as diesel engineer. Later he became assistant chief engineer, then chief engineer, and vice president and chief engineer in 1947.

Mr. Stevenson is president of Oberlin College and his selection was based on the valuable counsel that his background and experience can give on various aspects of the company's business, and particularly in the field of public relations.

Dow Chemical Co.—L. J. Richards, chief engineer of the Midland Div. since 1934, has been named director of engineering, according to Dr. Mark E. Putnam, vice president and general manager. E. R. MacLaughlin was advanced to head the Midland Div. engineering department. Creation of the new post occupied by Mr. Richards is intended to coordinate the activities of the Company's divisional engineering departments, which have been operated independently.

Sterling Electric Motors, Inc.—Carl E. Johnson, for many years president, was elected board chairman, and Earl Mendenhall, associated with Mr. Johnson for over 34 years, was elected president of the organization. Mr. Johnson will devote his time to the further development and improvement of power drives. Mr. Mendenhall will further the development and expansion of existing manufacturing plants and engineering and sales offices.

Fairbanks, Morse & Co.—Robert H. Morse, Jr., president, has announced that the company is planning construction of a $5,000,000 scale plant in the greater Kansas City area. When completed the plant will add materially to the production of scales. St. Johnsbury, Vt., and East Moline, Ill. plants will continue to manufacture scales.

OBITUARIES

Graver Tank & Mfg. Co.—Edward B. Heyden, 52, head of Graver Construction Co., and vice president of Graver Tank & Mfg. Co., Inc., died at his home in Cranford, New Jersey, April 18, 1950.

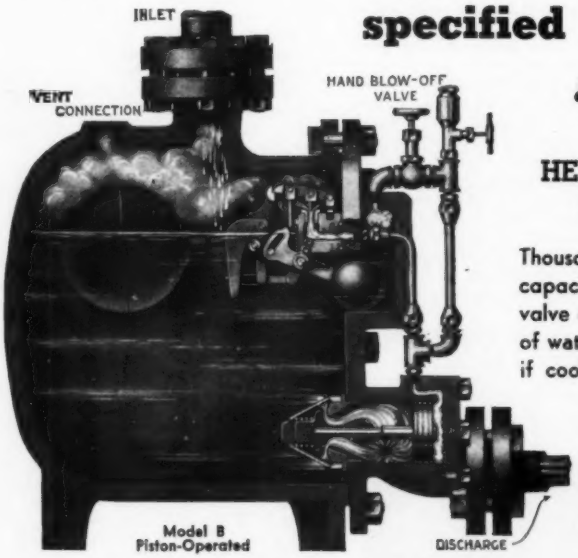
Worthington Pump and Machinery Corp.—The death of George R. Probst, manager of steam turbine sales, in Wellsville, N. Y., on May 14, 1950 was announced recently. Maynard D. Church, will temporarily take over the duties of Mr. Probst.

After a brief illness, Joseph E. Holvec, hydraulic engineer, Worthington Pump and Machinery Corporation, died May 20, at Mountainside Hospital, Montclair, N. J. Credited with many patents covering hydraulic applications in the steel, mining, pulp and paper, and petroleum industries, Mr. Holveck's name is particularly well known for his work on auxiliaries for steel descaling systems and, most notably for log debarking systems.

Brooks Rotameter Co.—Stephen A. Brooks, president, died on March 29, 1950, in Jamison, Pa., his home community, after a long illness. Mr. Brooks, who was 54 years old, was a chemical engineer.

General Electric Co.—Guy S. Hyatt, department comptroller of the General Electric Co. apparatus dept., died suddenly April 30 at his Schenectady, N. Y., home. He was 46 years old.

NICHOLSON "*Super*"... most widely specified trap for power plants



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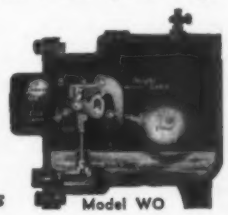
STEAM PURIFIERS, HEADERS, SEPARATORS, HEATERS, SUPERHEATED STEAM LINES

Thousands of installations attest to the enormous drainage capacity of this Nicholson trap. Piston-operated and with valve orifices up to 2" diam., it discharges large volumes of water almost instantly. Other features: won't leak even if cooked dry; rugged; working parts of stainless steel. Pressures, 2 to 650 lbs. The lowest price large capacity trap.

NICHOLSON WEIGHT-OPERATED TRAPS — Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.



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Catalog 250 or see Sweet's

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 18)

the spindle couples to the counting mechanism. After six seconds, the coupling disengages and the dial reading is the correct rpm for the shaft because the scale is calibrated to ten times the revolutions counted.

The model 944 measures rotative speeds to 1,000 rpm. The model 145 is for speeds as high as 10,000 rpm. Both are mounted in shockproof, neoprene-lined moisture-proof and dust-proof steel cases. Accuracy is retained under extreme climatic conditions as well as in magnetic fields. A 90-deg male and 60-deg female tip is provided to fit varied measurement problems. A 6-in. circumference wheel tip is also available for measuring belting speed.

328—SPRING CUSHIONS ABRASIVE SAW BLADES

The "Save-A-Blade" dial instantly adjusts blade cutting pressure by a single setting of the dial to conform to the hardness or softness of the material cut on masonry saws made by the Clipper Mfg. Co.

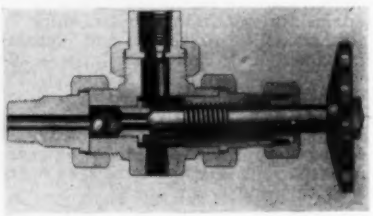
Cushioning protection, which the pressure equalizer spring provides, makes the control particularly effective when cutting with diamond blades. A quick movement of the dial to the "diamond" setting and blade-cutting pressure is automatically set to give fastest cutting with longest blade life. The dial, coupled with the new factory sealed pump, makes wet cutting efficient. When switching from wet to dry cutting, there is no need to disconnect the V-Belt on the "Wet-or-Dry" pump, which cannot be damaged when cutting dry.

329—DOUBLE-UNION VALVES ALLOW REMOVAL OF GAGE

Three double-union gage valves have been announced by the Jergusen Gage & Valve Co. Design and construction, with union connection to both the gage and the tank or vessel, makes it possible to turn the gage in any desired angle or remove it, without removing the valves or draining the liquid from the vessel by undoing the union nuts on the gage side.

New valves include two offset valves, No. 66-U and No. 46-U, and a steam-jacketed globe type valve, the No. 93-U. The two offset types are designed with a body which has gage and vent or drain connections offset ⅞ in. so the interior of the flat glass gage may be cleaned without removal of the gage. These two models are also used on side connected gages for maximum visibility between fixed centers.

The No. 93-U Valve, being a steam jacketed globe valve type, eliminates the necessity of costly steam tracing, and is available either with or without a stainless-steel ball-check safety shutoff.



Features include plain or quick closing, stainless-steel trim, and interchangeable unions, nuts and tailpieces. All are available with tailpieces ½ or ¾ in. male, or ½ in. female; and all are available in various metals to withstand corrosive or other conditions.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

330—SPOT-LIGHTS MATCH FLUORESCENTS

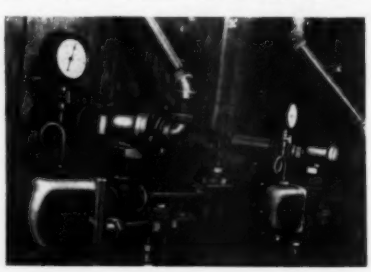
Lighting that will fit in with and follow the architectural design of stores, has been made available by Sylvania Electric Products Inc., with the introduction of six new incandescent spotlight fixtures. Known as Trimspots, these units match the company's series of thirteen shielded fluorescent fixtures.

Both the single and twin spotlight units are designed as companions to the two-and four-lamp fluorescent fixtures and have the same style decorative end pieces. Each Trimspot fixture is equipped with one or two 150-w PAR-38 spot lamps which can be rotated in a 360-degree arc and tilted up to an angle of approximately 20 degrees.

Either the single or the double spotlights can be placed between two fluorescent units, at intersecting corners of the fluorescent fixtures or at the end of a row of lighting, thus utilizing the advantages of both the incandescent and fluorescent light sources.

331—CIRCULATOR AND TRAP SPEED STEAM FLOW

Steam circulating system that accelerates the flow of steam and condensate in the steam spaces of platen presses and horizontal tubular heating surfaces has been developed by the Sarco Co., Inc.



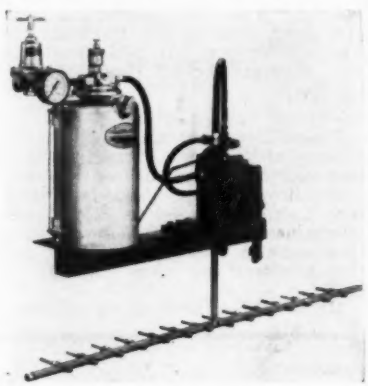
In this type of surface, the flow of condensate to the steam trap is usually very sluggish, resulting in slow heat transfer and therefore poor efficiency, for which the steam trap is not responsible.

The Sarco circulating system consists of a float trap and a circulator. This circulator is an injector which uses the uncondensed steam to induce turbulence in the flow of condensate, thus improving the heat transfer and speeding up production with a saving of steam.

Technical bulletin No. 4 contains full information and many easy-to-read diagrams.

332—LUBRICATOR OILS I-BEAM CONVEYORS

Automatic conveyor lubricator with multiple outlets for oiling chain-link-pins and trolley wheels on I-beam conveyors has been designed by J. N. Fauver Co. The manifold has fourteen outlets 2⅜ in. apart to lubricate the chain-link-pins, which are relatively closely placed. Trolley wheels are also lubricated by nozzles attached to the tripping mechanism and directed straight downward. Oil is directed at the point where the wheels may rotate against the hub at the end of the wheel-pin bearings, as on some conveyors. Oil reservoir consists of a 2-gal container, equipped with air regulator and pressure gages.



333—RUST-INHIBITING PAINT COVERS DAMP SURFACES

Rust-inhibiting oil-base paint has been added to the list of maintenance products offered by United Laboratories, Inc. Known as certified rust inhibitor No. 425, the product features the ability to serve as both rust preventative and finish coat in one application. In addition to this feature, it may be applied to damp surfaces, an advantageous quality in many applications. The product penetrates rapidly through the rusted surface, instantly expelling moisture from beneath. Resistant to fumes, salt air and weather, No. 425 may be applied to either new metal or that which has already rusted. Withstands dry heat up to 500 F and is available in a choice of several colors.

334—WATTMETER OBVIATES SERVICE INTERRUPTION

Hook-on wattmeter, applicable to active and reactive power measurements in single and polyphase circuits, has been introduced by General Electric's Meter and Instrument

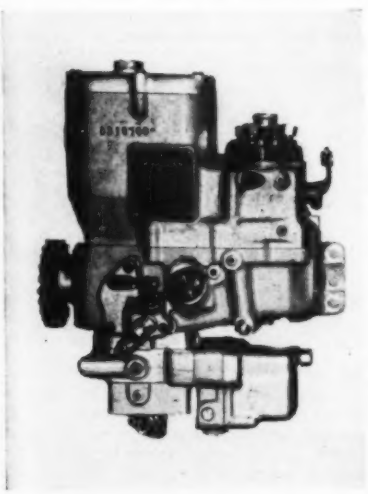
Div. Designated as Type AK-2, the device enables measurements to be taken without service interruption. A removable magnetic hook surrounds the current carrying conductor, and potential leads are connected

as in a conventional single-phase wattmeter. Three-phase balanced power measurement is accomplished by passing two power leads through the hook and connecting the potential leads to these same two power leads.

Through the use of a single dial switch, a selection of any one of six power measurement ranges is available to provide readings from 3 to 300 kw. The simple-switching, direct-reading meter was introduced as a companion unit to the AK-1 hook-on voltammeter.

335—FUEL PUMPS ARE SMALLER

Refinement to the Cummins fuel system is a new fuel pump, 65% lighter and 56% smaller, as announced by Cummins Engine Co., Inc. Known as the DD (double-disk)



pump, the new unit is designed for longer life operation and for easier servicing. Now offered as standard equipment on the 300-hp and 275-hp models, the pump also is available as optional equipment on other Cummins models. A tandem arrangement is standard on the 12-cyl, 400-hp and 550-hp models.

Design of the pump enables unit replacement of the fuel pressure pumps, distributor

DRACCO DUST CONTROL *Recovers*

80 to 100 TONS

Per Day

There are 8 *WAYS TO INCREASE EFFICIENCY* with DRACCO Dust Control

If it were possible to compute the value of recoveries made by DRACCO Dust Control, it would run into MANY MILLIONS each year. In the installation shown above, 56 compartments, DH Type, handle 280,000 C.F. of air per minute and recover from 80 to 100 tons of dust per day. DRACCO Dust Control saves money by increasing plant efficiency in 8 ways. If you have Dust, find out from DRACCO Engineers how many of the 8 ways will save YOU money. Consult DRACCO Engineers for an analysis of your dust or fume problem.

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

PALMETTO® PACKING
with a Twist
TO CHOKE THE COST ON YOUR DOWNTIME

Reckon the "bargain" in makeshift packings in terms of constant maintenance, frequent repacking — and equipment failure . . . you'll understand why so many select Palmetto for "greater economy in the long run."

Each strand of Palmetto Twist, for example, is built for 600 F superheated steam — thus gives bonus service at all lower temperatures.

Each strand is lubricant-impregnated for friction-free, self-lubricating performance. Will not harden. Will not bind valve stems or pump shafts.

Each strand is of high grade, high tensile Canadian white asbestos — quality that counts for better service, longer life all the way.

For all the facts on non-hardening, non-binding Palmetto Twist, write for new Bulletin LP-10.

GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA

Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

disks, and governor assembly without removing the pump from the engine. Alignment in the servicing of the pump is minimized since all parts, and the bearings in which they rotate, are included in the same housing.

336—SOCKET WRENCHES FEATURE SMOOTH ACTION

Snap-on Tools Corp. announces a new ½ in. square-drive, socket wrench set redesigned to give better efficiency and appearance. It consists of fifteen double hexagon sockets ranging in size from 7/16 to

1¼ in., a 10-in. ratchet, 18-in. nut spinner, 15-in. sliding bar, 18¾-in. speeder, universal joint, and 3½, 5- and 10-in. extension bars.

Sockets feature a lock-groove in each of the four sides of the drive hole to grip the friction ball on the square drive of the handle. Handles have a grip that conforms to the shape of the hand. All handle units have a friction ball locking device held in place by a welch plug and, because the ball seats better by this method, less dirt and grit will enter. For servicing or cleaning, the parts are easily removed and replaced. The ratchet has a 32 tooth action and only a 12-degree handle swing is necessary for operation in restricted areas. Pawl is designed to engage two teeth of the gear at all times, thus furnishing smooth action and additional strength.

337—CORROSION CONTROL OF COOLANTS

Slide comparator has been developed by W. A. Taylor & Co. for corrosion control in the cooling fluids of air conditioning systems, refrigerating brines, diesel-engine cooling systems and condenser cooling water. With a single slide comparator, it is possible to check the pH (active alkalinity) and the chromate content. The comparator consists of a base and slide, both molded from plastic. The base contains 2 vials of pH indicator with 0.5-ml pipettes and 5-5-ml test tubes. Each color-standard slide contains five pH standards and four chromate standards with values suitable for the application.

To determine the pH, three test tubes are filled with the sample to the mark (5 ml), and placed in the holes back of the three slots in the base. To the middle tube is added 0.5 ml of pH indicator and mixed well. Color-standard slide is moved in front of the test samples until a match is obtained. The pH is then read off directly from the values on the slide.

The chromate determination is made by placing a test tube full of sample in the base, and comparing directly with the chromate standards. The values are then read off directly from the values on the slide.

338—PUMP HAS UNIQUE OIL SEAL SYSTEM

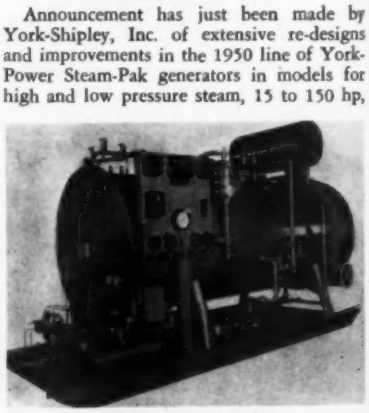
Announced by Kinney Manufacturing Co., a small, compound vacuum pump, Model CVD 3534, employs a unique oil-seal pumping system that has been satisfactory where

high vacuum and consistent pumping speeds are necessary.

The pump has a free air displacement of 4.9 cfm and operates with a 1/3 hp motor. On a blank test, each unit is required to produce McLeod gage absolute pressure readings of 0.1 micron (0.001 mm Hg.) or better. This model is compact . . . less than 16 in. in height. Double sealing-oil reservoirs provide continuous oil purification which promotes the consistent production of high vacuum regardless of surrounding atmospheric conditions. The pump requires no "warm-up" period.

339—PACKAGED STEAM UNITS FEATURE EFFICIENCY

Announcement has just been made by York-Shipley, Inc. of extensive re-designs and improvements in the 1950 line of York-Power Steam-Pak generators in models for high and low pressure steam, 15 to 150 hp,



for gas, oil, or a combination gas and oil. All models have the "Iris Shutter" for control of burner air, a linkage assembly, which permits independent adjustment of either blower air or fuel, ability to handle the heavier and cheaper residual oil, and electronic type combustion safety controls.

Gas-fired models are equipped with a motorized gas shut-off valve to insure instant and positive shut-off of main gas flow when required, as well as slow-opening action for lighting off.

All units have the full welded construction of pressure vessels, and have sufficient connections for either left or right hand installation. Pressure boilers are now equipped with a double blow down on each end, and

a below-the-water-line connection for indirect heating of domestic or process water. Low-pressure boilers are available with immersion domestic water coils.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

340—PERMANENT MAGNETS REMOVE TRAMP IRON

Eriez Mfg. Co., has introduced an improved group of Alnico plate magnets for separation of tramp iron from materials in process. Known as Atomagnets, they come in three models with different magnetic strengths; the "Extrapower," the "Ultrapower," and the "Superpower." Each also comes in a full range of sizes. They are lighter in weight and more streamlined in design.

The magnet castings are now fully encased with a formed cover; parts are riveted

rather than bolted, eliminating warping and bending of large size magnets; and hinges on standard models are made of aluminum. Insulation of the plate's working surface confines magnetic strength to where it is desired; and a flush, instead of recessed air gap on the plate face prevents gathering of fine iron in this crucial location.

Installations can be made on chutes, hoppers and spouts; over inspection tables and moving belt lines, either in operating or original equipment.

341—KIT QUICKLY TESTS WATER HARDNESS

Announced by The Bersworth Chemical Co., the Versene kit enables anyone to test the hardness of water in less than two minutes. The test is accurate to within one grain of hardness per gallon.

The kit is packaged in a pocket-size plastic box. It contains three vials of chemi-

cals and one combination measuring and mixing vial. Enough chemical is included to make more than 50 separate tests, de-

THERE'S

No Reducing Problem

when you use

Masoneilan

Reducing Valves

Masoneilan Pressure Regulators —for steam, water or air service —reduce waste, cut costs and save money by holding pressures within the required limits without constant maintenance. That's why you find plant men in all types of industry using and recommending them for reducing service. Their experience proves that Masoneilan valves eliminate pressure reducing problems.

No. 11 for steam service — Sizes ½" to 4". Reduced pressure ranges between 5 and 75 psi or 75 and 225 psi. Maximum working pressure 250 psi.

No. 227 for water service—Sizes ¼" to 2". Reduced pressure range between 10 and 60 psi. Maximum working pressure 150 psi. Also available for air service from ¼" to 1".

Your local Mason-Neilan industrial distributor is ready to serve you from stock; or write

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Mason-Neilan Regulator Company

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Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago • St. Louis Philadelphia • Houston • Denver • Pittsburgh • Cleveland • Cincinnati • Tulsa • Atlanta Detroit • Los Angeles • San Francisco • Salt Lake City • El Paso • Boise • Albuquerque Charlotte, N. C. Mason-Neilan Regulator Company, Ltd., Montreal and Toronto

Visit the Fifth National Instrument Exhibit at Memorial Auditorium in Buffalo, September 18-22, 1950. See our display in Booths Nos. 418, 420, and 422.

Simplify Your Hose Buying with Hewitt-Robins Servall®

SERVALL'S UTILITY IS BUILT IN

Molded and braided construction makes Servall tough and long lasting. Synthetic rubber tube resists gasoline and oil, acids and alkalies; carcass of high tenacity rayon provides a rugged, highly flexible wall; long-wearing red synthetic cover resists weathering and abrasion.

New All-Service Hose Ends Need for Many "Special" Types

If your plant has many intermittent, light-duty uses for hose, Hewitt-Robins new Servall all-service hose is the efficient economical answer!

SERVALL IS IDEAL for handling air, water, moderate amounts of gasoline and oil, mild chemicals, low-pressure insecticides and the like. It solves the inventory and cost problems of buying many special hoses for infrequent use, and it ends the hazard of using a hose designed for only one service.

SPECIFICALLY, Servall is recommended for: All types of small air tools; for air cleaning and general air service; hot or cold water service within recommended working pressures; low-pressure spraying and fire-fighting; intermittent gasoline and oil service where the hose is not continuously filled; weak inorganic acids and alkalies and water contaminants; grease, paint (not lacquer) and insecticide spraying.

HERE IS MANY-HOSES-IN-ONE; dependable wherever and whenever a special heavy-duty hose is not required. Buy Servall. Buy it by the reel, use it as you need it. Think of the money you save!

BULLETIN 137 gives complete data —ID, OD, working pressures, reel lengths, etc. Call your Hewitt Rubber distributor (see "Rubber Products" in classified 'phone book) or write Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N.Y.

HEWITT-ROBINS SERVALL HOSE

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

pending on the hardness of the water. Refills are available. Full directions accompany each kit.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

342—SHAFT SEAL STOPS LIQUIDS AND AIR

A new mechanical shaft-seal assembly, introduced by Marlo Pumps on their self-priming centrifugal pumps, has a rotating seal collar made from Hycar nitrile rubber, a product of B. F. Goodrich Chemical Co.

The "SF" shaft seal is furnished in either self-lubricating or grease lubricated models. The former is used with clear

liquids and the latter with fluids which contain abrasive solids. Both assemblies have the same principal elements; stationary seal ring C (carbon), stationary seal ring gaskets (Hycar), rotating seal ring B (Meehanite), and rubber seal collar A (Hycar).

Shaft sealing is obtained by two perfectly flat surfaces, which are run together and held in sealing contact by the rubber seal collar. The collar drives the rotating ring, keeps it in contact with the stationary ring, and seals the rotating ring to pump shaft.

The rubber possesses resilience, good abrasion resistance, good oil and heat resistance, high tensile strength, and low compression set at high temperatures.

343—PLUG-IN PANEL ALLOWS FLEXIBILITY

The Square D Co. has announced a new Plug-In multi-breaker panelette that meets most a-c lighting and appliance circuit switching and protection requirements. Standardization components are stocked by distributors.

Construction features include 12 x 4½ in. box designed for easy wiring, door with locks, lugs only from 4 to 28 circuits, circuit breaker mains from 4 to 20 circuits.

Thermal-magnetic plug-in units are rated 15, 20, 30, 40 or 50 amp. They are interchangeable with the NMO panelboard and MO 12 or MO 20 load centers.

A flexible packaging procedure permits

carton containing box and bus structure to take additional plug-in units and trims after their selection. Thus, one complete package can quickly be assembled to meet any specific customer requirement. The panel is available for single phase 3-wire, or three-phase 4-wire systems.

344—TESTER INDICATES FLUORESCENT TROUBLES

Fluorescent fixture tester called the Flur-Test is being announced by Ideal Industries,

Inc. This pocket-size tester locates the trouble and indicates whether it is in the circuit, starter or tube, saving the time involved in trial-and-error method of replacing starters and tubes or both. The tester fits into starter socket to make all three tests. Two models are available—one for fixtures with 15 to 40-w tubes and one for fixtures with 85 to 100 w tubes. Where the starter socket is concealed behind fixture tube, an extension adapter is used to provide clearance.

345—IMPULSE STEAM TRAP USES STAINLESS STEEL

Produced by Yarnall-Waring Co., the Yarway impulse steam trap now uses a stainless steel body in place of the cold-rolled-steel cadmium-plated body previously furnished for working pressures up to 400 lbs and temperatures up to 450 F. To provide additional resistance to the abrasive wear and corrosion encountered in severe steam trapping service, the trap is made with body of Type 416 bar stock. Internal parts, as before, are made of selected stainless alloys.

STAYING POWER
For hydraulic pressure, for boiler or desuperheater feed—use this Aldrich-Groff "POWR-SAVR" Controllable Capacity Pump.

ENGINEERS and plant managers — these men in particular — know that machinery must have *staying power*. Whereas breakdown or interrupted production costs money, *staying power* pays!

The automatic stroke-transforming action of the "POWR-SAVR" Pump (above) supplies only that capacity actually needed. As for mechanical reliability, over 500 of these Aldrich-Groff Units — many with as much as ten years of service — are successfully operating today.

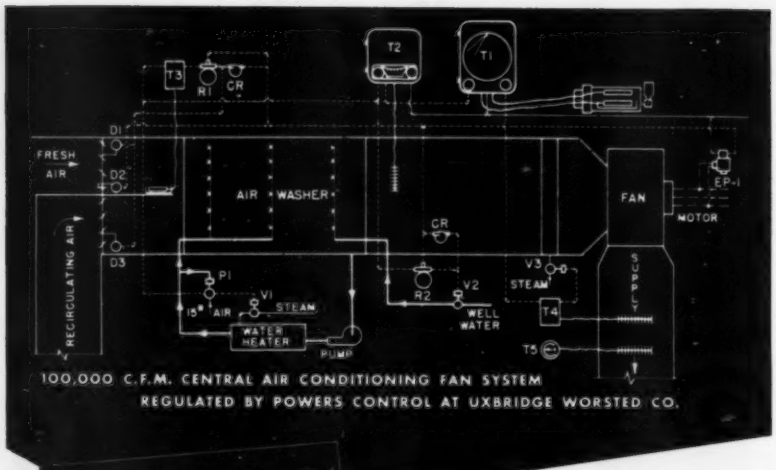
Wherever high pressure pumping is required, use an Aldrich Pump. You, like the 500 satisfied users mentioned above, will profit from a good investment. For technical information, request Data Sheet 65.

Representatives: Birmingham • Bolivar, N.Y. • Boston • Buffalo • Chicago • Cincinnati Cleveland • Denver • Detroit • Duluth • Houston • Jacksonville • Los Angeles New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa

THE ALDRICH PUMP COMPANY

PINE STREET, ALLENTOWN, PENNSYLVANIA

All Aldrich Pumps Have **STAYING POWER**



100,000 C.F.M. CENTRAL AIR CONDITIONING FAN SYSTEM
REGULATED BY POWERS CONTROL AT UXBRIDGE WORSTED CO.

POWERS

AIR CONDITIONING CONTROL
with year 'round accuracy of 1°F. plus or minus regulates over 300,000 C.F.M. at—
UXBRIDGE WORSTED CO.

(T-1) POWERS WET AND DRY BULB RECORDING-CONTROLLING PSYCHROMETERS at Uxbridge Worsted Mill regulate—

One	100,000	C.F.M.	fan system
"	80,000	"	"
"	12,000	"	"
Two	60,000	"	"

(T-2) POWERS INDICATING SUB-MASTER DEWPOINT REGULATORS automatically control the air washers

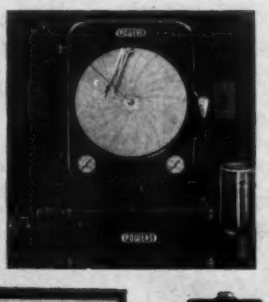
POWERS dampers, valves, relays and other devices are used with T-1 and T-2 to obtain the accurate control mentioned above.

20 to 30% Increase in Efficiency—claimed for modern air conditioning installed in carding, spinning, winding, weaving and sewing departments in Uxbridge, Mass., Mill. Dry bulb temperature of 78° F. and Wet bulb at 68° F.—accurately maintained at all times by POWERS control—helps produce a better product at lower cost.

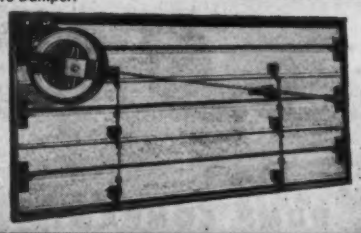
For Better Air Conditioning Control and valuable aid in selecting the right equipment for your requirements contact our nearest office: BOSTON, 125 St. Botolph St.—NEW YORK, 231 E. 46th St.—PHILADELPHIA, 2240 N. Broad St.—GREENSBORO, N.C., Jefferson Standard Bldg.—ATLANTA, 142 Spring St.—Also BIRMINGHAM and NASHVILLE. (ACU)

A FEW OF THE MANY DIFFERENT TYPES OF POWERS CONTROLS

Above: T-2 Powers Series 100 Sub-master Dewpoint Indicating Regulator.
At Right: Powers Series 100 Wet and Dry Bulb Recording-Controlling Psychrometer.
Below: D-1-2-3 Powers Louvre Damper.



Above: T-3-4 Powers Type K Remote Bulb Thermostat.
Below: T-5 Powers Remote Bulb Dial Indicating Thermometer.

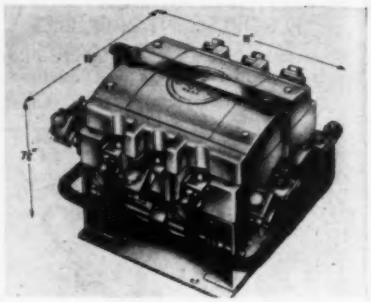


V-1-2-3 Powers Diaphragm Valve

THE POWERS REGULATOR CO.
OFFICES IN 50 CITIES • SEE YOUR PHONE BOOK
Over 55 Years of Temperature and Humidity Control

346—SIZE 4 STARTER IS COMPACT

The Arrow-Hart & Hegeman Electric Co. has announced a size 4 "RA" Magnetic Starter. Measuring 11 x 10 x 7¼ in., the compactness is achieved by a right angle balanced mechanism, which employs full



magnet power without lifting extra weight. A knee-action bellcrank fulcrum multiplies the leverage and transfers it from a vertical to a horizontal plane. Contact pressure is increased, while wattage consumption is reduced, by the leverage.

Arc control is obtained by guiding the arc across and between quenching and baffle plates for maximum suppression. High heatproof silicon chutes enclose each contact, which are shaped to form a magnetic "blow-out" field forcing the arc in the correct direction for control and extinction.

347—CHEMICAL FLOW IS CONTROLLED

Electro-chemical feed control is announced by The Permutit Co. to feed chemicals continuously and proportional to the flow of water entering a tank. It features accuracy of control, variation in the rate of feeding chemicals, absence of small measuring orifices, and prevention of chemical dust from escaping to the atmosphere.

In operation, water flows through an integrating raw-water meter. Integrator makes an electrical contact when a predetermined quantity of water has passed through the meter, starting the control unit and a time switch which limits the operating time. The quantity of chemical solution is always proportional to the flow. Ratio of chemical solution fed can be varied and the quantity of chemicals may also be varied by changing the density of solution in the chemical tank. A remote dial control can be obtained.

348—SWIVEL SPOUT IS DUST TIGHT

Dust-tight swivel spout, announced by the Richardson Scale Co., is designed to eliminate routing of batches by dusty swivels or conveyor plows. Increased scale flexibility is reported obtainable by using the spout to "chute" pre-weighed discharges to different bins or stations, to deliver from a bin to several different scales, or to deliver pre-weighed discharges to two different delivery trucks. Numerous other applications in feed mills, grain elevators, and industrial plants are possible.

Remote automatic positioning of the spout can be synchronized with other functions by means of a timer. The swivel spout is available with either manual or automatic controls.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

349—PILOT LIGHT IS SELF CONTAINED

Low-cost, ready-to-install, neon-type pilot light, designed for switchboards, instrument and other panels, is announced by Industrial Devices, Inc. Completely enclosed in a plastic case, the Omni-Glow quickly mounts through a ½ in. hole. Maximum diameter

is less than ⅝ in., allowing mountings as close as 13/16 in. on centers. Maximum extension behind panel is only 1½ in. For high temperatures, a special nylon housing is available. Standard coloring is red, with other colors available.

Neon lamp, equipped wth 4 in. tinned leads, is rated 75/150 v a-c or d-c, and is available in special resistances for various voltages.

350—WEATHERPROOF HOLDER TAKES R-SERIES LAMPS

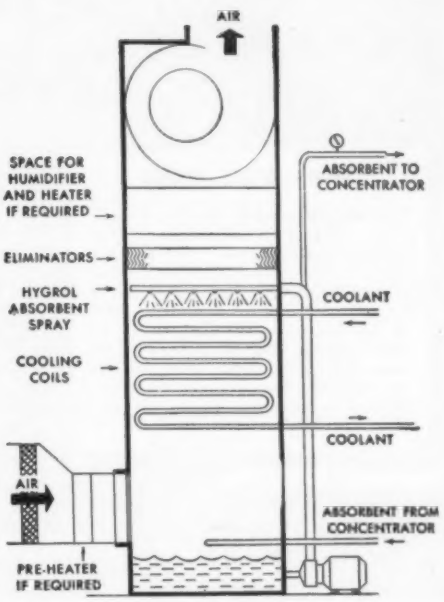
Water proof, all-weather flood-light holder is announced by the Mattox Machine Co., for use in industrial plants. Tests indicate that the R-40 and R-60 hard glass pyrex lamps, when used in the holder, give 48.2% longer bulb life and 51% greater lighting efficiency.

The light weight (1 lb, 6 oz) aluminum casting, so waterproof it can be submerged and operated under water if necessary, is sealed with silicone material which retains its mechanical strength and resiliency at from minus 100 F to 500 F in all climatic conditions. The holder will accommodate the 300, 500, 750 and even the 1000 w mogul-base lamps, and can be used in any position.

(Advertisement)

New Method Gives Precise Control in Air Conditioning

Niagara "Controlled Humidity Method" Uses Hygrol, Hygienic Liquid Absorbent

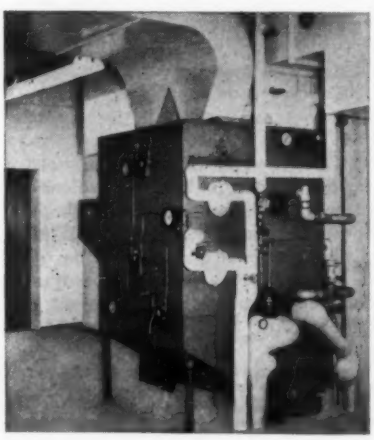


NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

● The Niagara "Controlled Humidity Method" is a new system of air conditioning giving complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required. A condition of 15 grains of moisture per pound of air at 85 deg. F. dry bulb temperature has been produced without refrigeration.

The apparatus is enclosed in a casing thru which the air is drawn by fans. The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.



The same equipment may be used to provide winter air conditioning when required, by installing a tempering coil at the outdoor intake, an humidifier, and a reheat coil above the eliminators.

This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit, and mutiple unit installations are practical. It is expected that, by reducing the need for refrigeration, the cost of air conditioning will be reduced by this method. Applications generally are in a temperature range from 35 deg. F. upward. Below the freezing temperature of water, the Niagara "No-Frost" method is applicable.

The equipment is protected by U. S. and foreign patents. Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

For further information, write Niagara Blower Company, Dept. IP, 405 Lexington Ave., New York 17, N. Y.

MAGNOLIA
Die-Cast
Bearing
Bronze
THIN WALL BARS
New Magnolia Stock Size Chart shows bar sizes manufactured with thinner than standard walls. These specials are available for factory shipment in sizes above 4" O.D. and may permit you to reduce your present purchase weight or machine time. Die-Cast by an exclusive process, each bar is free of blowholes and burnt-in-sand. Lead particles are unusually fine and well dispersed. Write for size chart A-1 or see your Magnolia Distributor.
U.S. PAT. OFF.
SOLD THROUGH INDUSTRIAL DISTRIBUTORS
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ELIZABETH 4, N. J.

Get Automatic CONTROL and SHUT-OFF of Air-Gases Liquids • Solids

ROCKWELL

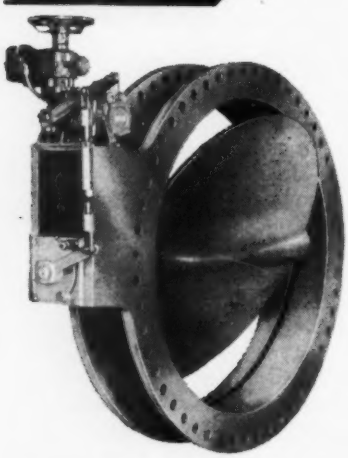
BUTTERFLY VALVES

Boost Operating Efficiency

To meet the growing demand for automatic valves for control and quick shut-off of air, gas, liquids and semi-solids, Rockwell Butterfly Valves are available in sizes from 1" to 84" pipe size, with construction to withstand almost any chemical or physical action, or temperature.

Such valves may be equipped with such mechanisms as electric motor; Limitorque control with push button stations and indicating lights to show full open and full closed position of the valve blade; air diaphragm operator, solenoid operator, hydraulic or pneumatic cylinder with or without limit switch, etc. Auxiliary hand wheel or lever controls can be applied for emergency manual operation.

Boost the efficiency of your plant or equipment with Rockwell Valves. Ask for our catalog.



60" butterfly valve with motor operator and remote control, and auxiliary hand wheel control.

W. S. ROCKWELL CO.
230 Eliot St., Fairfield, Conn.

NEW BULLETINS

(Continued from page 22)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 37.

swers the question "when is it economical to retire a group of meters?" Resembling a circular slide rule, the evaluator has scales for such factors as cost of new meters, age of old meters, and excess annual cost of old meters over new meters. General Electric Co.

Gas Analyzer (2T). Two four-page bulletins contain helpful information on gas analyzing and a U-path steam calorimeter. Descriptions are given for both items on application, specifications and theory. Ellison Draft Gage Co.

MATERIAL HANDLING

Magnetic Separator (2U). New 8-page catalog presents the application, operation and design of drum-type magnetic separators. Information on correct selection for a given application together with data on capacities and dimensions is included. Typical diagrams are shown with recommendations. Dings Magnetic Separator Co.

Electric Hoists (2V). Colorful 8-page bulletin describes construction of hoists and includes specifications on capacities, power, hoisting speeds and dimensions. Accessory items are also included. Whiting Corp.

Conveyors (2W). Booklet (18 pages) interestingly illustrated with photographs and diagrams, gives the current solutions to conveyor problems in many industries. Accessory items such as bin dischargers, mixers and car spotters are also included. Stephens-Adamson Mfg. Co.

Belt Conveyors (2X). Forty pages of engineering information include data, illustrations and descriptions of types, drives, capacities and applications. Charts permit the engineer to analyze his conveyor problems and lay out the specifications. Barber-Greene Co.

Flyash Collectors (2Y). Attractive eight-page folder contains engineering data, construction details, general dimension table and capacity chart. Typical flow diagram chart indicates how this unit collector is to be installed, and views with cutaways illustrate ash collecting. Buell Engineering Co., Inc.

POWER TRANSMISSION

Speed Controls (2Z). Infinitely variable speed drives with automatic controls of the electronic, mechanical, pneumatic or hydraulic type are described in a colorful 8-page bulletin. Capacities are from 1 to 25 hp. Diagrams illustrate many applications. Link-Belt Co.

Gearmotors (3A). Folder lists specifications including speed, torque, capacity and dimensions of a new line of gearmotors rated up to 5 hp with speed

reductions as high as 37 to 1. Abart Gear and Machine Co.

Mercury Clutches (3B). Bulletin describes the mercury clutch and lists various applications from lathes to air conditioners. Illustrated, 7 pages. Another bulletin of 4 pages covers electric motor installations. Automatic Steel Products Inc.

PUMPS AND ACCESSORIES

Centrifugal Pumps (3C). New engineering approach is described in 3-page bulletin on vertical, double-case pumps for capacities up to 450 gpm (increased by manifolding), pressures to 5000 psi and temperatures to 900 F. Advantages and applications for the ingenious constructions are given. United Centrifugal Pumps, Div. of United Iron Works.

Rotary Pumps (3D). Bulletin (8 pages) titled "Facts" illustrates design, construction, maintenance, operation and application of rotary pumps. Details of sliding and swinging vane types with selection table for specifying and other data of interest to engineers, maintenance men and plant operators included. Blackmer Pump Co.

Vacuum Pumps (3E). Cycloidal pumps, capable of producing vacuums of from 4 to 26 in. Hg in large capacities are described in 12-page bulletin. Application illustrations, cross-sections of pumps, installation diagrams and operating curves are included. Roots-Connersville Blower Corp.

Air Powered Pumps (3F). Pictorial 16-page bulletin covers all applications of an air-operated, controlled volume pump. Design details and advantages are illustrated and explained. Flow diagrams, utilizing this pump, are shown for several types of installation. Milton Roy Co.

Two Stage Pump (3G). Features of three, two stage, double suction centrifugal pumps are illustrated and described in detail. Dimensional data and selection chart are included. These pumps operate at 400 to 1300 ft head. Worthington Pump and Machinery Corp.

Centrifugal Pumps (3H). Four-page flier describes a line of cradle-mounted centrifugal pumps. A sectional view of the pump is shown with all of its salient features pointed out and described. In addition, the various types of drives are illustrated. Ingersoll-Rand Co.

Positive Volume Pumps (3J). Rotary and centrifugal positive blowers and exhausters in single and multiple stages are illustrated and thoroughly discussed in a four page bulletin. Features of each pump are explained, and typical applications are suggested. Roots-Connersville Blower Corp.

Self-priming Pump (3K). Unique construction details of this self-priming, centrifugal pump are explained in a four-page multi-color bulletin. Cutaway view, captioned with leads to the important parts, gives a clear picture of all working parts. Dimensional chart is listed for 3500 rpm, 1½ to 10 hp sizes. Allis-Chalmers Mfg. Co.

NON-FLUID OIL
TRADE MARK REGISTERED

Stops Oil Showers From Overhead Cranes

Constant oil leakage from overhead crane motors results in high oil and application cost. Bearings must be filled frequently to insure protection from failure.

Drippage causes other heavy losses. Tracks and pillars must be cleaned to lessen fire hazard. Stock cleaning costs are increased when oil deposits must be removed.

NON-FLUID OIL stops such losses. Saves money because it does not drip or leak. You get clean lubrication and clean products at lower cost.

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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

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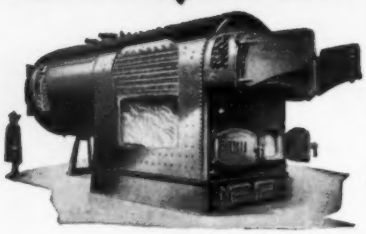

10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

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Better PIPE TOOLS

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"Reversible," "Standard" and "Ideal" types in all sizes. Jaws are drop forged from special steel, are carefully milled, heat treated hardened and tested. The *Handles* are forged spring steel. The *Chains* are proof-tested to 2/3 catalog strength (1,200 lb. to 40,000 lb.). "Reversible" Jaws give double jaw life. "Standard" Jaws have extra bearing on the handle and forged-in chain guides. The "Ideal" Tongs have V shaped teeth for a sure grip on irregular shapes — fittings, etc.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5237 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

Vertical Centrifugal Pump (3L). Colorful bulletin covers all phases pertinent to installation, maintenance and construction features of an encased vertical centrifugal pump. Characteristics such as capacities, heads, drives and construction materials are analyzed. Peerless Pump Div., Food Machinery and Chemical Corp.

TOOLS AND SPECIALTIES

Tube Bender (3M). Catalog sheet describes pipe, bar and angle-iron bender with new hydraulic attachment. Capacity 2 in. pipe. Hossfeld Mfg. Co.

Lapping Procedure (3N). Booklet illustrates and describes a method of flat lapping for extremely close tolerances. Photographs, diagrammatic drawings and complete data provide information for all industries whose manufacturing operations include precision surface flatness and RMS finish. Crane Packing Co.

Air Tools (3P). Illustrated 44-page catalog contains complete specifications on 147 different types and models of portable air tools and their accessories, Many new tools, recently designed, are shown for the first time. Applications for each tool are reviewed. Buckeye Tools Corp.

VALVES, PIPING AND FITTINGS

Strainers (3Q). Strainers with screens and perforated metal elements are described in recently enlarged 6-page bulletin. Specifications for steam, liquids or gas, with illustrations, are included. Yarnall-Waring Co.

Liquid-Level Gage Valve (3R). Four loose-leaf sheets give technical data, construction, and installation instructions with diagrams on valves for liquid-level gages. Jerguson Gage & Valve Co.

Non-Return Valves (3S). Technical descriptions, engineering diagrams of body and yoke patterns, parts list and operation and installation instructions are included in 8-page bulletin on triple-acting non-return and check valves. Golden-Anderson Valve Specialty Co.

Diaphragm Valves (3T). Flow control of corrosive and hard-to-handle liquids by means of diaphragm valves is discussed in 4-page bulletin. Cross-section drawings show construction and operation of the valves. Three tables chart availability as to size, type and material for most applications. Hills-McCanna Co.

Pipe Price Card (3U). New data card designed to help in purchasing carbon-steel pipe or estimating cost of apparatus using this material is available. Card tabulates the present day prices, per hundred feet, of seamless carbon-steel pipe 1½ in. nominal dia and smaller; also for standard weight, extra-weight and double-extra-weight pipe. Babcock & Wilcox Tube Co.

Valve Positioner (3V). Description of the apparatus and how it functions to overcome stuffing box friction to maintain valve-plug position proportional to output pressure are contained in 8-page bulletin. Mason-Neilan Regulator Co.

Air Eliminator (3W). Two-page bulletin describes an automatic air eliminator for steam lines at pressures up to 150 lb. Gorton Heating Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

Piping Products (3X). In addition to data on a line of welding fittings, a 66-page technical reference section for engineers of welded piping systems is contained in this 184-page hard-cover book. There are charts, tables, graphs, of every description; welding data, design formulas, metallurgical information; also digests of more than 20 ASA and ASTM specifications covering pipe, fittings and flanges, with a discussion of code requirements for pressure piping and many other such subjects. Midwest Piping & Supply Co., Inc.

Traps (3Y). Factual, illustrated 32-page catalog describes five types of thermostatic steam traps for operating pressures to 225 psi; two types of expansion steam traps for pressures to 250 psi; three types of weight-operated traps for pressures up to 1500 psi and piston-operated traps for pressures up to 650 psi. Capacity tables and installa-

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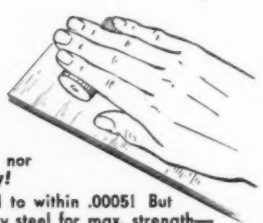
LOVEJOY UNIVERSAL JOINTS



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Put a Lovejoy Universal Joint on a surface plate and roll it. You will neither see daylight nor wobble. That's *concentricity!*
CONCENTRICITY guaranteed to within .0005! But there's a lot more! Finest alloy steel for max. strength—grinding to infinite accuracy—absolutely flush rivets—greater angle of operation.

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Also Lovejoy Flexible Couplings, and Lovejoy Variable Speed Transmission

tion data are included. W. H. Nicholson & Co.

Oil Seals (3Z). Brochure is a sixteen page handbook of useful data for anyone needing information on oil seals. Photographs show application and installation details. Drawings illustrate how the lip and heel construction of these non-metallic oil seals can be varied. The text gives other pertinent information of importance to designers, engineers and maintenance men. Johns-Manville.

Welding Fittings (4A). Working catalog that contains 88 pages covers the complete line of this manufacturer's welding fittings and flanges. Specifications, price list, sizes and dimensions are included for standard, heavy and extra heavy fittings. Helpful index, located inside the cover, aids in readily finding any type of fitting or flange. Grinnell Co., Inc.

Boiler Return Traps (4C). (Alternating receivers and lift traps.) Bulletin 165 explains how to return condensate from heating systems to the boiler without danger of flooding return lines. The return traps used can serve to lift condensate to levels higher than otherwise possible. Sketches show the piping connections. Sarco Co., Inc.

Steam Equipment (4D). Condensed 12-page catalog covers a portion of this company's steam plant equipment such as: high and low pressure blow-off valves, water columns and gages, liquid level indicators and recorders, expansion joints, steam traps and strainers. Specifications and selection data are included. Yarnall-Waring Co.

HEATING, VENTILATING AND AIR-CONDITIONING

Blowers (4E). Informative 2-page bulletin on blowers gives dimensional information including engineering layout, application and design data, blower number, rating—cfm at listed rpm—and other facts. Standard Stoker Co.

Dust Collectors (4F). How to cut maintenance costs with efficient, automatic self-cleaning, collecting system is the subject of 4-page bulletin. Also contains general data and dimensions of the unit. Turner and Haws Engineering Co., Inc.

Filters (4G). Descriptive and illustrative literature on new dry panel filters gives 8 pages of informative data such as: performance data and resistance curves, selection and installation charts, and table of sizes and shipping weights. Features also are discussed. Dollinger Corp.

Unit Heaters (4J). Bulletin on turbine driven unit heaters covers the unique features of this company's heater. The electric motor, for operating the fan, has been eliminated. This unit is driven by a steam turbine, the exhaust from the turbine being piped into the heater section for heating the air. Complete details, which include engineering data and dimensions both on the revolving discharge units and the fixed discharge units, are given. L. J. Wing Mfg. Co.

(Continued on page 135)

HERE'S A HEAVY-DUTY HUSKY with a 7½ cubic foot DUST APPETITE!

The New HOFFCO-VAC #50 PORTABLE VACUUM CLEANER

WRITE FOR BULLETIN A-794

★ Improved design, 5 H.P. model operates two 50-foot lines of 1½-inch hose simultaneously, or one 75 or 100-foot length of 2-inch hose.

★ Self-lubricated ball bearings.

★ Spring-mounted vacuum unit.

★ Longer operating period.

★ Easy dust disposal.

For high-capacity, continuous cleaning, the new Hoffco-Vac #50 is the all-purpose, two-sweeper machine! Specifically designed for use where large dust accumulations are to be handled—where non-stop cleaning is necessary—or where superior separation is a requirement. Handles like lighter, smaller machines. Successor to the famous Hoffco-Vac originated in 1939, the new #50 is one of 4 sizes of portables built by Hoffman. Stationary systems available, too, in a wide range of sizes. Write today for literature.

HOFFMAN BUILDS MULTISTAGE CENTRIFUGAL BLOWERS and EXHAUSTERS

All capacities up to 10,000 c.f.m. and various air pressures up to 8 lbs. Low maintenance and power costs. Write for Bulletin A-650.

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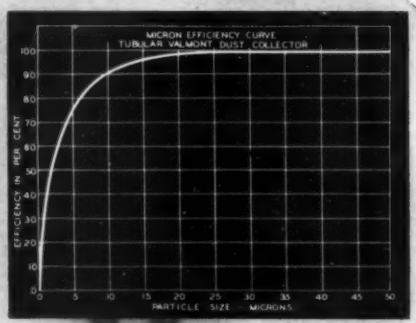
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO. LTD. NEWMARKET, ONT.

THE VALMONT TYPE S COLLECTOR

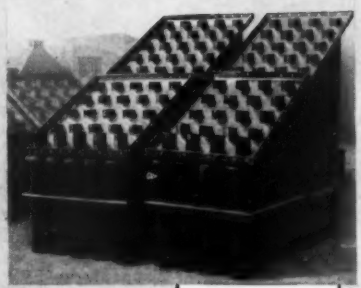
CATALOG DIGEST

The following information is taken from the New Bulletin on P-D Valmont Type S Collector. For Complete Bulletin containing dimension tables, sizes, nomographs and suggested installation plans, write our Project and Sales Engineers.



P-D EFFICIENCY CURVE

VALMONT TYPE S TUBES SHOWING FLOW OF GASES AND INLET



HORIZONTAL TYPE TUBE SHEET SECTIONS KNOWN AS "UNI-BLOCS"

METHOD OF NESTING TUBES—REDUCES TURBULENCE . . . SAVES SPACE

HIGH EFFICIENCY—The outstanding contribution to higher efficiency in the P-D Valmont Type S is the inlet slot design. A patented development of Prat-Daniel, this inlet is high and narrow, reducing the radial distance of dust-travel. To explain its effect on dust collection, we quote from Cyclone Dust Collector Design, by Melvin W. First, Paper No. 49-A-127, presented at the Annual Meeting of the American Society of Mechanical Engineers, Nov. 27—Dec. 2, 1949, page 14.

> "Entry width is an important variable in cyclone efficiency, as it controls the stream width. This, in turn, directly controls the radial distance particles must traverse to reach the cyclone wall and be separated by centrifugal force. The smaller the radial distance to be traversed, the lower the tangential velocity needed (less energy loss) and the smaller the particle that can be successfully separated for a given flow rate."

LONG LIFE—Extensive tests were made to determine the wear factor. All types of abrasive dusts were run at accelerated speeds, against various metals simultaneously and steel proved to be the most resistant to erosion.

Another long life factor is the lower velocity required due to the small tube diameter. It is a well-known fact that reduction of tube diameter produces higher centrifugal force. Thus, efficiencies are maintained at the lower load ranges.

MASS PRODUCTION METHODS—The P-D method of "uni-bloc" construction permits manufacture and assembly of sub-sections at the factory. These are shipped to the field and easily erected, either vertically or horizontally, to fit the layout. Savings in cost of erection are thus realized yet the collector is "tailor assembled" to fit the installation requirements.

SMALL SPACE FACTOR—Because of close nesting of tubes possible in P-D Valmont Type S Collectors, the space required for this apparatus is much less than conventional collectors. In many cases, P-D units have been fitted into spaces that could accommodate no other type.

The Thermix Corporation, our Sales and Project Engineers are specialists in the art of dust collection. Consult them about your dust problems.

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(Offices in 28 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd.

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PRAT-DANIEL CORPORATION

Designers and Manufacturers of Power Plant Equipment for Over 25 Years

69-6 WATER STREET • EAST PORT CHESTER, CONN.

(Continued from page 133)

MISCELLANEOUS

Abrasive Grit (4L). Folder gives typical performance results on this nonmetallic, silica-free blast grit. Also gives the advantages over sand for cleaning and finishing. American Wheelabrator & Equipment Corp.

Plate Fabrication (4M). Colorful 14-page bulletin contains numerous photographs of items fabricated by this company. One page gives welding-procedure qualifications and one entire section is devoted to construction details and specifications of all types of heat exchangers. Downingtown Iron Works, Inc.

Communication System (4N). Literature describes a system of instantaneous communication that gives tight control over production through written contact with all departments from laboratory to shipping. Contains many suggestions that help avoid delays between divisions. Telautograph Corp.

Fire Extinguishing System (4P). Fully illustrated literature describes a new carbon dioxide fire extinguishing system for protecting your record vault or file room. American-LaFrance-Foamite Corp.

Corrosion-Resistant Alloys (4Q). New edition of the 40-page booklet "Hastelloy High-Strength, Nickel-Base, Corrosion-Resistant Alloys" tells the complete story of the four alloys—what they are, how they can be fabricated, and also how they can be used to combat severe corrosion. Several pages in the booklet are devoted to descriptions and suggested uses of the various forms of the alloys. Proper procedures for the welding, heat-treating, hot-working, cold-working, surface preparation, machining, and grinding are also given. Haynes Stellite Div. Union Carbide and Carbon Corp.

Lubrication (4R). Pocket-sized booklet on industrial lubrication titled "Eleven Ways to Cut Production Costs" presents examples of economies attained through modern handling and application of greases and oils for increased production use of machinery, and elimination of machine repair and labor costs. Alemite Div. Stewart-Warner Corp.

Metallurgy (4U). Informative 24-page bulletin on modern metallurgy gives photographs and charts as well as tables and engineering data, to answer the question of which metal or alloy is best suited for a given purpose. Hunt-Spiller Manufacturing Corp.

Non-Slip Floor Plates (4V). Illustrated 8-page bulletin on abrasive rolled steel plates describes the advantages of non-slip, heavy-duty steel floors. Tables give dimensions and allowable uniform load in addition to fabricating data. Alan Wood Steel Co.

Protective Coatings (4W). Folder, "Matchless Long Term Protection" presents the story of sealing against moisture, vapor and corrosion. Contains a series of operational photographs and sketches together with factual data. Insul-Mastic Corp.

Centralized Lubrication (4X). "Studies in Centralized Lubrication," a 6-page booklet, presents a series of typical case studies to show the striking economies possible with a centralized system of lubrication. The Farval Corp.

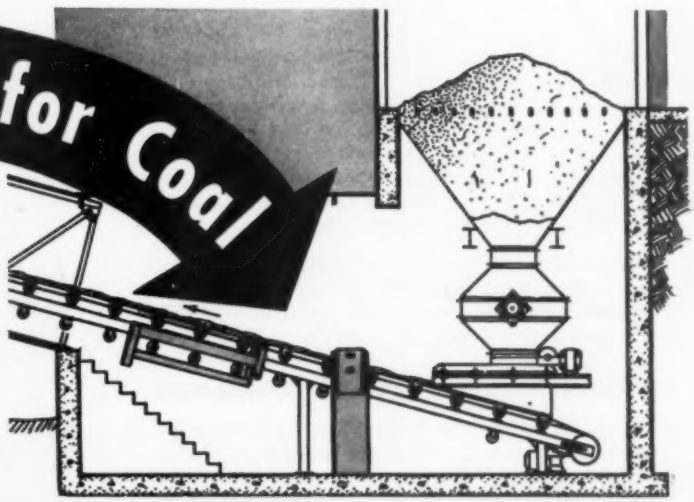
For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information mailed to you.

Air Hose (4Z). Pocket-sized 4-page bulletin explains the design, construction and rubber compounds of this general-service rayon cord air hose. Hewitt Rubber Div. Hewitt-Robins, Inc.

Foundry Coatings (5A). Illustrated 4-page bulletin describes the use of colloidal graphite dispersions in the foundry. Contains many helpful application suggestions, in addition to descriptive formula on coating of chills, molds, and patterns. Acheson Colloids Corp.

Engineering System (5C). Illustrated 28-page booklet shows how a system of uniform engineering, design, procurement and construction does the job of modernization or expansion from flowsheet to operation of the plant. The Kuljian Corp.

NEW Control for Coal



Builders Conveyoflo fits perfectly into your coal-handling plans. It's accurate, dependable, and adaptable. Besides weighing the coal in transit, Conveyoflo gives positive control of pulverizers and is ideal for operating rate-of-flow indicators at your central control panel. Conveyoflo saves valuable floor space — it fits right into present conveyors and requires no overhead framework or external lever system. For complete information and descriptive bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 357 Harris Ave., Providence 1, R. I.

Builders makes a complete line of flow meters and controllers for liquids, steam, air, gas, and dry materials . . . including The Venturi Meter and Chlorinizers (chlorine gas feeders).

BUILDERS PROVIDENCE *Instruments*

BUILDERS *Conveyoflo* Features

ACCURATE — within ± ½ of 1% of actual weight for most of its range.

COMPACT — no overhead framework. Minimum floor space required.

DURABLE — no fragile mechanisms. Conveyoflo is pneumatically actuated.

TWO BASIC DESIGNS — available as self-contained unit or for installation in existing conveyors.

INCLINED OR HORIZONTAL — Conveyoflo operates with equal efficiency whether horizontal or inclined.

UNINTERRUPTED FLOW — Conveyoflo weighs, records, or controls flow right on existing belt — avoids costly interruption of flow.

How WILSON makes short work of difficult TUBE EXPANDER PROBLEMS

Wilson's wide-range line of precision-made Wilson-Dudgeon Tube Expanders is backed by 97 years of experience in this specialized field. That is why the Wilson Engineering Staff can tackle unusual tube expander problems . . . and solve them quickly.

HERE ARE A FEW EXAMPLES:

Wilson-Dudgeon Model 38 Tube Expander

• A manufacturer of beverage coolers had to expand a ¼" OD tube into a 2" square header. The total length of the expander, including the mandrel, could not exceed 1¼". Wilson-Dudgeon Tube Expanders were supplied for this difficult application.

• A heat exchanger manufacturer had to join two pieces of tubing of the same diameter together without the use of a coupling. A Wilson-Dudgeon belling and flaring expander made this possible. This expander bells out one end of the tubing so that the other piece can be sweated into it.

Wilson-Dudgeon Model 41 Tube Expander

• An Eastern manufacturer had to expand a 10" diameter blind cap 1¼" deep into a header. A conventional expander could not be used because the mandrel could not project through the blind header. A special Wilson-Dudgeon Expander was engineered to do this job very simply and rapidly.

No matter what your tube expander problem, you can be sure of getting a Wilson-Dudgeon Tube Expander that will fit your specific application. Write us, giving full details or send for Bulletin 380.

WILSON TUBE CLEANERS CUT DOWN-TIME

Wilson Tube Cleaners quickly handle the toughest deposits . . . clean both straight and curved ferrous and non-ferrous tubes . . . turn costly down-time into profitable production time. For complete information on Wilson's complete line of plant-proved tube cleaners, write today for Catalog 76.

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TW-771

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WILSON TUBE CLEANERS
WILSON-DUDGEON TUBE EXPANDERS AND SPECIALTIES

"SPOT" NEWS OF INDUSTRY

(Continued from page 115)

number of disabling injuries per 1,000,000 man-hours, was 10.14 in 1949—a reduction of 12% from 1948.

Communications industry again led all other industries by turning in the lowest employe frequency rate. Its rate was 2.14—an 18% reduction from 1948. Aircraft manufacturing again ranked second with 4.25, followed by the electrical equipment industry with 4.83 and steel with 4.96.

Lumbering stayed at the bottom of the frequency list in 1949, with a 47.72 rate, but this represented a 3% reduction. Although coal mining reduced the frequency of its accidents 10%, it could not climb from the next to last position with a 41.48 rate. Mining other than coal was third from the bottom, below marine transportation.

Accident severity rate for all industries reporting to the Council, based on the number of days lost per 1,000 man-hours, was 1.02 last year—a reduction of 9% from 1948.

Communications also had the lowest severity rate, leading all other industries with a rate of .15—a 17% drop from 1948. Printing and publishing came up from fourth place in 1948 to tie for second in 1949 with a substantial 47% reduction to give it a rate of .23. The tobacco industry equalled this rate, even though it showed a 21% increase. The service industry was third, with a 63% rate reduction boosting it up from 15th place in 1948.

In terms of severity, coal mining once more stayed at the bottom of the list, with the highest accident severity rate of 6.84. This, however, was a 10% reduction. Mining other than coal achieved a 27% reduction in severity rate to move up a notch ahead of lumbering, which finished next to the bottom with a 4.6 rate.

Standby Fire Pumps Are Diesel Driven

Caterpillar Tractor Co. has announced that six units of its diesel engine line—D13000, D397, D364, D386, D375, and D318—are approved for emergency standby fire protection applications by Fire Underwriters Laboratories, Inc.,

STEAM DRUM ON WAY TO WORLD'S LARGEST BOILER

After a 600 mile journey from The Babcock and Wilcox Co. plant, this 116-ton steam drum will be installed in the world's largest boiler at the Hudson Avenue (Brooklyn) electric generating station of Consolidated Edison Co. of New York, Inc. The 66 ft drum, which is six ft in dia, was floated on a lighter from Greenville, N. J. around the Battery to the New York Naval Shipyard. It was then loaded on a trailer and hauled the rest of the way by truck

a non-profit testing organization sponsored by the National Board of Fire Underwriters.

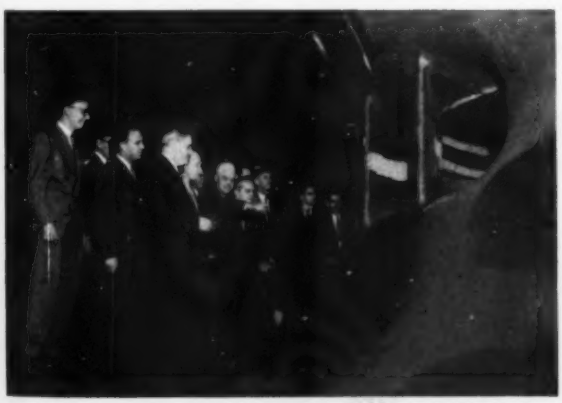
These engines may now be installed with direct-connected fire pumps for the purpose of supplying factories and other buildings with water in case of fire. Installations are usually operated as auxiliaries to other fire fighting equipment and fire-protection devices. They utilize a separate water supply, such as a river, creek, well, or a different water main than that supplying the building, to insure two sources of water at a time of fire.

Painting Research Council Formed

Formation of the Steel Structures Painting Council has been announced by John E. Jackson, treasurer of the American Institute of Steel Construction. This group will consist of representatives of the associations and organizations concerned with the manufacture, specifications and use of paints and other coatings for the protection of steel surfaces.

Organizations represented are the American Institute of Steel Construction; American Water Works Association; American Railway Engineering Association; American Chemical Society; American Society for Testing Materials; Association of American Railroads; Lead Industries Association; National Paint, Varnish & Lacquer Association; Federation of Paint & Varnish Production Clubs; Office of the Chief of Engineers, U. S. Army; Engineering Research & Development Laboratory, Fort Belvoir, Va.; Steel Plate Fabricators Association; National Association of Corrosion Engineers; American Society of Civil Engineers; Mellon Institute of Industrial Research; U. S. Bureau of Public Roads; and American Iron & Steel Institute.

Members elected to the executive committee are: J. E. Jackson, American Institute of Steel Construction, Chairman; G. G. Sward, National Paint, Varnish & Lacquer Association; E. E. Michaels, Steel Plate Fabricators Association; V. V. Kendall, American Iron & Steel Institute; and G. M. Magee, American Railway Engineering Association.



BULL SHOALS HYDRAULIC TURBINES NEAR COMPLETION

One of the three major hydraulic turbine and generator units in process of manufacture for Bull Shoals is being inspected at Allis-Chalmers by members of Erik Floor & Associates, Inc., Chicago and Allis-Chalmers Engineers. Each turbine is rated 62,000 hp at a speed of 128½ rpm under 190 ft head. In the inspection group are (left to right) G. Ellis, H. Libner, A. Weiner, J. L. Schnitz, vice president of Erik Floor, N. Mandel, W. J. Rheingans and Emil Gross of Allis-Chalmers hydraulic department, and Messrs P. Fuchs, R. M. Cape, C. Maitre, L. Mosier, R. Palmer

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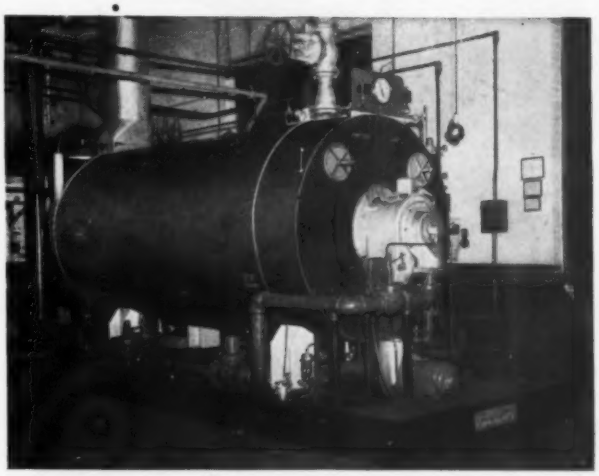

writes *E. Milota*, general manager of *Buckeye Garment Rental Company, Cleveland, Ohio*, about new 200 HP unit installed in their industrial laundry. "Its automatic operation assures ample steam regardless of load variation!"

Steam users throughout the world report their operating costs are reduced as much as 40% through Powermaster installations. High and low pressure units from 15 to 500 HP—for light oil, heavy oil, gas or combination gas-oil firing—give you advantages like these:

- Low fuel consumption through high efficiency
- Low-cost installation due to packaged design
- Reduced man-hours through automatic operation
- A.S.M.E. construction—Underwriters' approval
- Widespread service by factory-trained men

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36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

KRANE KAR

MOVES LOADS EASIER - FASTER - SLASHES COST OF MATERIALS HANDLING

KRANE KAR handles loads at Sides as well as at Front.

AUTOMOTIVE USERS:
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At your service 24 hours every day because it is gasoline-powered (no layups for battery charging). Works inside and outside your plant. KRANE KAR serves also as an auxiliary to existing crane facilities . . . and as an emergency tool for plant maintenance. Let us show you. Ask for Bulletin No. 79 or for a Sales-Engineer.

1½, 2½, 5 and 10 ton capacities.

SILENT HOIST & CRANE CO.
856 63rd ST., BROOKLYN 20, N. Y.

Dr. C. Earl Webb, American Institute of Steel Construction, was appointed Chairman of the Finance Committee.

A Research and Publication Committee was appointed comprising J. O. Jackson, Chairman, American Institute of Steel Construction; M. A. Roose, American Railway Engineering Association; Arnold J. Eickhoff, American Society for Testing Materials; A. J. Liebman, National Association of Corrosion Engineers and N. W. Morgan, U. S. Bureau of Public Roads.

Purposes of the new Council were announced as follows: (1) to review the art of cleaning and painting steel structures through literature surveys, conferences, and other means in order to determine and outline the best methods developed up to the present time; (2) to issue, if found feasible, a code or specification covering practical and economical methods of surface preparation and painting steel structures, based on the present knowledge of the membership of the Council; (3) to perform in its own organization, or by engaging outside individuals or organizations, further research to reduce or prevent the corrosion of steel structures by surface preparation and by the application of coatings, paint and other materials and to determine the initial and annual costs thereof; and (4) to issue from time to time recommendations intended to further improve, and to make more effective and more economical the protection of steel structures; such recommendations to be made available to specification and code writing committees.

Supercharged Dual-Fuel Engines Will Burn Sewage-Sludge Gas

Supercharged, dual-fuel engines, that will operate on sewage gas, are now being installed in Bay Park, Long Island. They are part of a $7,500,000 new Nassau County sewage system serving 53% of the county area and 83% of the population.

Five engines, totaling 2925 hp, will be furnished by Worthington Pump and Machinery Corp. Two units will drive Electric Machinery Manufacturing Co. a-c generators, which will supply electrical energy for the main sewage-treatment-plant power requirements. Two other engines will drive Roots-Connersville rotary positive displacement type blowers, which will supply 8,500 cfm of air at 8 psi.

CASTING WEIGHED WITH STRAIN GAGES

Huge 35-ton steel casting is weighed by means of resistance wire strain gages, at the Baldwin Locomotive Works. Gages are bonded to short vertical columns incorporated in three load cells of 50,000 lb capacity each. The cells were developed for accurate weighing of all heavy items

Fifth and largest unit has a combination drive for a 500-kw generator and 16,000-cfm blower. The engine is direct connected to the generator. The blower is connected by means of a special disconnecting type coupling, and it is disconnected when the unit is used for power generation.

In full operation, the plant will produce daily about 170,000 cu ft of sewage gas having a heating value from 550 to 600 Btu per cu ft. The gas will be available for use as a fuel to operate the engines.

When completed, the new Nassau County Plant will include the most advanced power-generating and air-blowing equipment. Improvements in engine and plant design made in recent years will be included. First, dual-fuel operation will permit the use of gas or oil fuel at any ratio on the high compression diesel cycle with its inherently high thermal efficiency. Second, engine supercharging will allow maximum power for a given space allotment and also produce the highest thermal efficiency of any heat-engine arrangement available today.

National Bureau Tests Alloys Of Phosphorus With Cobalt Or Nickel

Electro-depositing of cobalt or nickel alloyed with as much as 15% of phosphorus has been developed by Abner Brenner, Dwight E. Couch, and Eugenia K. Williams of the National Bureau of Standards. The new phosphorus alloys deposit easier than chromium, and they are hard, corrosion-resistant, and bright.

Plating baths, for depositing the phosphorus alloys, consist of common nickel or cobalt salts such as sulfate or chloride. Phosphorous acid is added as a source of phosphorus in the deposit. The baths are operated at a low pH—between 0.5 and 1.5—depending on the composition. To maintain the desired acidity in the cathode film, the solution must be buffered. The Bureau has found that phosphoric acid is one of the best chemicals for this purpose. Plating baths are kept at 75 C or above as cathode current efficiency is very low and the deposits are weak at room temperature. Current densities should be between 5 and 40 amp per square decimeter.

Appearance of deposits depends upon phosphorus content. Alloys with less than 2% of phosphorus are usually smooth with a mat finish; but as the percentage of phosphorus increases, the surfaces become brighter, reaching a

DRAVO EXECUTIVES ON INSPECTION TOUR

Nine Dravo Corporation's executives and operating personnel receive first hand information to acquaint them with the diversified activities in which various corporate divisions engage. The officials are inspecting features of the reconstruction of a Monongahela River lock at Braddock, Pa., by the Contracting Div. of Dravo Corp.

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Yes! A ***faster, easier, more economical*** way to clean machinery and equipment. One blast from a powerful CLEMENTS-CADILLAC blower-suction cleaner does the trick — sends Dirt, Dust, and Grit scurrying from every crack and crevice. Use it for hard-to-get-at cleaning jobs all over your plant.

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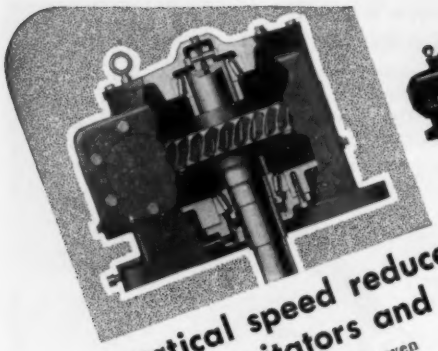

Type ND, with drive shaft down

A new vertical speed reducer to drive agitators and mixers

IMPROVED worm gear drive—in seven sizes each of two types—ready for prompt delivery. Designed especially for agitators and mixers, and for use with overhead chain conveyors, as well.

WRITE for a copy of the new Cleveland Bulletin No. 125, describing types NU and ND, with capacity charts and dimension data. The Cleveland Worm & Gear Co., 3253 East 80th St., Cleveland 4, Ohio.

CLEVELAND Worm Gear *Speed Reducers*

HANDIEST ADDRESS IN PITTSBURGH IS THE PITTSBURGHER HOTEL

400 Rooms each with free radio, bath and circulating ice water. Garage service

Singles from $4.00
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Conveniently located in downtown Pittsburgh, it is quickly reached from highways, railroad stations and airports. In the immediate vicinity are theatres, department stores and important office buildings.

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PITTSBURGH 30, PA.
JOSEPH F. DUDDY, MANAGER

peak of brightness at a phosphorus content of about 10%. When such deposits are plated on a dull surface, they increase in brightness as they become thicker.

Phosphorus alloys, momentarily immersed in a solution of an oxidizing agent or made anodic in plating bath, form a jet black film on the metal's surface. This film is hard and adherent and appears to have possibilities for decorative use.

Photomicrographs of the low-phosphorus alloys show a columnar structure while the high-phosphorus alloys have a laminated or banded structure. X-ray diffraction patterns of high-phosphorus alloys indicate no crystalline structure. When heat-treated, the deposits develop a fine-grained structure instead of the large crystals characteristic of pure nickel or cobalt.

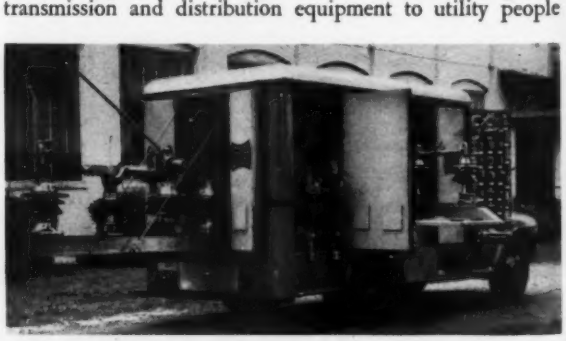
Hardness varies from 350 to 720 on the Vickers scale, increasing with phosphorus content. When the alloys are heat-treated at 400 C, they become much harder. For example, a heat-treated cobalt-phosphorus deposit containing about 10% phosphorus—hardness of over 1100 Vickers—is harder than electro-deposited chromium. Deposits heated as high as 800 C and cooled are not appreciably softer than the initial deposit. However, the alloys have poor "hot hardness" and above a temperature of 600 C are softer than unalloyed nickel or cobalt.

Low-phosphorus alloys become ductile after heat treatment at 800 C, deposits containing more than 1% of phosphorus are generally brittle. Alloys with higher percentages of phosphorus are highly resistant to corrosion and chemical attack. In the Bureau experiments nickel alloy with 10 to 14% of phosphorus was attacked considerably less by hydrochloric acid than was pure nickel.

Ease of deposition, hardness, and corrosion resistance of the new alloy suggest a number of commercial application possibilities. Their use is indicated for gages, cylinder walls, piston rings, and other machine parts where resistance to wear is an important factor. In this connection, the more rapid rate of deposition as compared with chromium and the better throwing power of the plating bath should be of considerable advantage. Although the phosphorus alloys are not as white as bright nickel, operation of the baths is much less critical than for proprietary bright nickel. The phosphorus alloys can be plated from a bath made up entirely of inorganic chemicals whereas bright-nickel plating solutions must contain an organic brightening agent.

New Southern States Mobile Display Unit Tours Country

Southern States Equipment Corp. has sent its second mobile display unit on the road to demonstrate power transmission and distribution equipment to utility people



throughout the Southeast and eastern seaboard. Advance notices will announce its visit to each community.

This orange and green truck will carry a comprehensive selection of newest equipment and samples of the latest

designs. An automatic switch operating mechanism makes possible push-button control of the switches in the display.

Field engineers, Thomas H. Ellison and Thomas D. James, Jr., will take turns accompanying the unit. Each will be joined by a sales representative for the area in which the unit is traveling.

Square D Display Coaches Begin 37 States Tour

Two unusual display and demonstration coaches, "The Detroiter" and "The Milwaukian", have started on a tour that will cover eastern, midwestern, southern and northern states. Through these coaches, Square D will present its

complete line of electrical distribution and control equipment to electrical distributors and contractors, architects and builders, and industrial plant engineers.

An experienced field engineer will travel with each coach, serving as "official guide", demonstrating devices, explaining new design features, and discussing specific applications.

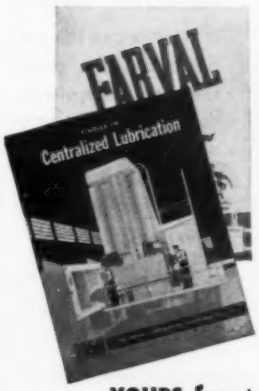
Liquid Diffusion Method Provides Low Cost Dust Control And Coal Conditioning

A new engineering service, known as "Liquid Diffusion", is now being made available to power plants by Johnson-March Corp., Philadelphia, Pa. The method is based upon the scientific application of liquid diffusion compounds and is said to have practical low cost applications: (1) to eliminate coal dust in breaker house and belt galleries; (2) to overcome coal stockpiling problems of windage loss, spontaneous combustion, and dust nuisance; (3) to control fly ash more easily with a minimum of moisture; and (4) to ease removal of boiler slag and other products of combustion from boiler tubes, superheaters, economizers, and preheaters.

The successful solution of dust control and moisture penetration problems is a three-step engineering job: (1) selection of the proper liquid diffusion compounds for the work to be done; (2) the controlled proportioning of these compounds in the carrying medium-water, oil or other liquid; and (3) the application of the solution at the right place, in the proper spray pattern, to produce the desired results automatically, effectively and economically.

Recognition of this three-fold problem led to the development of a new engineering division. Its ability to solve dust control and moisture penetration problems has been tested in key manufacturing industries, power plants,

New report on savings with centralized lubrication

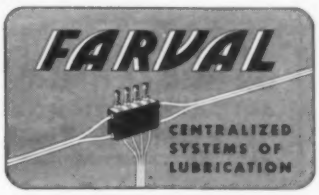


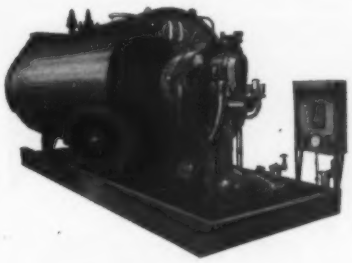
FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies—1950" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

YOURS for the asking





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Fully Automatic. Heavy Oil, No. 6.

60 to 500 Horsepower plus ample overload.

Efficiency and Capacity proved in every day practical service and fully guaranteed.

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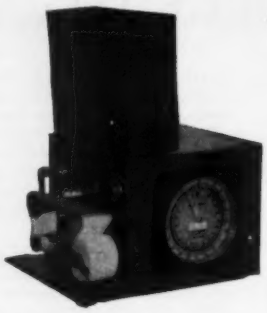

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it operates on the output of a scaler, photo tube, or other electrical unit . . . permanently records counts on a 2¼" tape . . . automatically resets to zero.

In Radioactive Research it saves precious time by eliminating many hours of manual labor, resulting in greater economy and efficiency.

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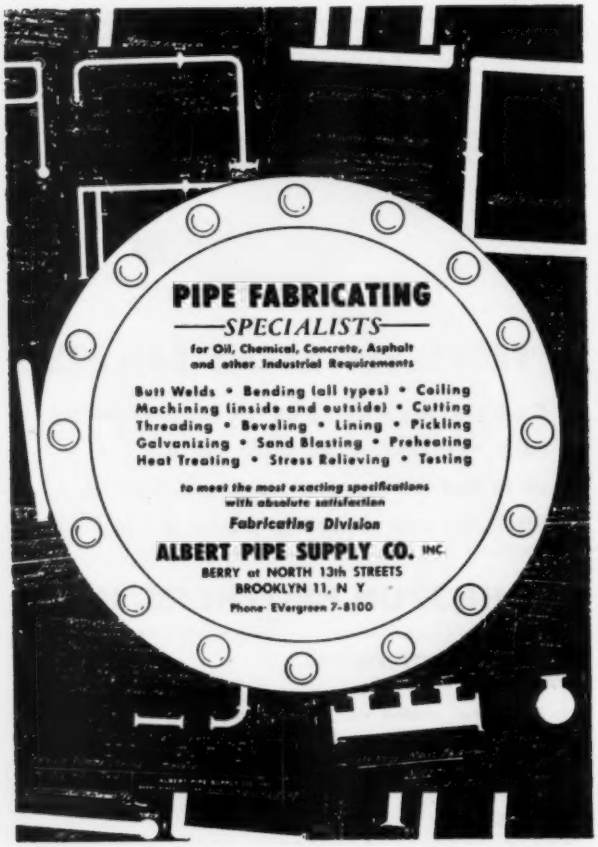
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to meet the most exacting specifications with absolute satisfaction
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foundries and mines. Johnson-March engineers design and supervise the installation of liquid diffusion systems to meet the needs of any size operation.

Remote Control System Operates Robot Lightship

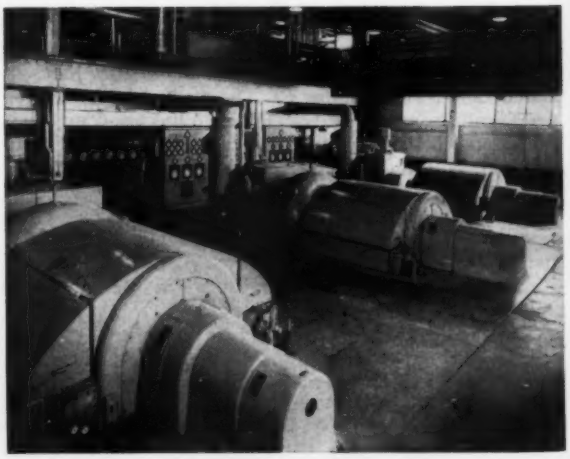
Manned only by an electronic "crew," a robot lightship—first ever built for ocean duty—will soon guide shipping into the nation's busiest port. The U. S. Coast Guard disclosed that the 91-ft-long lightship "EXP-99" is nearing completion. After a two-months' dock trial, the lightship will be given further tests under actual service conditions. These further service tests are designed to check the lightship's reliability before it is used as a replacement for a manned lightship.

With the aid of a remote control system developed by the Westinghouse Electric Corp., a single operator will have complete control over the lightship's signalling system. Westinghouse also built the three generators that will supply electricity for the light, radio beacon, and the fog signal, and supplied the controls for automatically starting the diesel engines that will drive the generators. One of the generators will be in operation continuously—the other two will be held in reserve.

Key to successful operation of the crewless lightship is the remote control system, called Visicode. This equipment uses short radio waves to send orders from the shore station

CORRECTION NOTICE

In the article "Welded Economizer Tube Returns Increase Efficiency" by Carl McLaughlin, Tube Turns Inc., March 1950 INDUSTRY AND POWER, the term "tube turn" was incorrectly applied. Actually there is no such word as "tube turn" in a generic sense. Tube Turn Inc., has a registered trade mark, "TUBE-TURN", and it is properly used only in conjunction with a product manufactured by this company. For example: TUBE-TURN elbows; TUBE-TURN returns; TUBE-TURN reducers; and TUBE-TURN saddles.

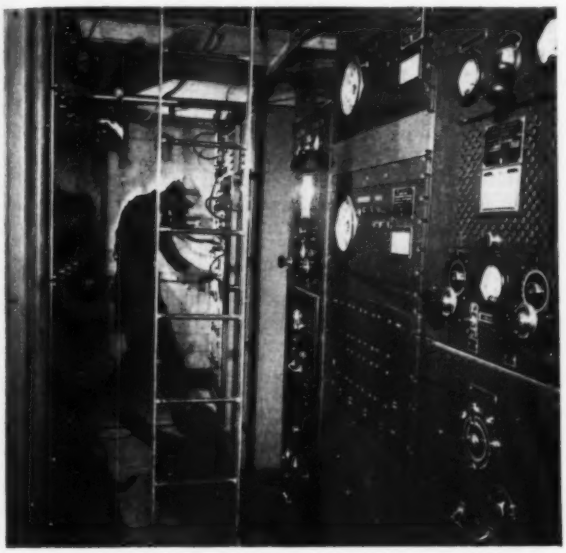


TURBINE-GENERATORS HAVE TWO-FOLD USAGE

Three 5,000-va turbine-generators develop electrical energy for the new multi-million dollar mill of Fibreboard Products, Inc., in Calif. Exhaust steam from the turbines is utilized to reduce the wood chips to cellulose fibres

to the ship. The waves are picked up by a receiver, executed by sensitive relays, and a return signal is sent to the operator notifying him that the proper equipment is operating.

To check the system and see that it is in working order, the operator on shore pushes a selection button and electrical impulses are sent from a shore transmitter to a receiver



on the ship. A white lamp on the panelboard lights up if the system is ready to operate.

The operator then pushes a control button and a different series of impulses speed to the ship's receiver, where electrical relays take over, automatically starting a diesel engine and electric generator.

Should the equipment fail to start, a green lamp—lighted while the generator is idle—remains on. The operator then can turn on the second or third diesel-generator combination. If one generator stops at any time another automatically starts, and the transmitter sends a series of impulses that changes the red light to flashing green and sounds an audible alarm.

Safety Posters Teach Personnel To Wear Safety Glasses

Safety glasses, not personal glasses, should be worn on the job by workers, is the theme of a new series of 10 x 13½ in. posters released by American Optical Co., Southbridge, Mass.

Designed to encourage workers to wear goggles, the posters point out that Rx safety glasses protect workers' eyes, whereas personal glasses do not. In addition, personal glasses should not be exposed to hazards that may chip, crack, or pit the lenses.

Welded Economizer Returns Cut Repair Bills $7500 a Year

Repair bills have been cut $7500 a year by modernizing the independent type of fuel economizers employed in a public utility steam plant. In addition, increased efficiency, brought about by the full availability of the economizers, has led to substantial savings.

Formerly, directional changes in the tubing were made with conventional flanged connections that often leaked, sometimes entailed shutdowns, and ran up maintenance cost. The refabricated tubing uses welding fittings for di-

New *VERSENE test kit determines total water hardness in less than *TWO MINUTES***

Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

Order The New Versene* Water Hardness Testing Kit today. $3.00 Postpaid. Send Checks or M.O. No. C.O.D.'s. Money Back Guarantee

We also manufacture and supply di sodium versenate (the di sodium salt of ethylene diamine tetra-acetic acid). This is the reagent used in the Schwarzenbach Method for the determination of water hardness. It is an analytical reagent grade chemical.

50 g. $2.00 100 g. $3.00 500 g. $10.00 Postpaid.

BERSWORTH CHEMICAL COMPANY
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The HALLOWELL FOREMAN'S DESK OF STEEL

HALLOWELL Steel Desks pay dividends in convenience and durability. Made of steel, these units take years of abuse without losing their trim appearance.

The smooth, firm writing surface stays that way. Drawers glide easily on ball bearing rollers. Built-in locks protect prints, papers, instruments, etc. No protruding handles to catch clothing or pull off.

Choice of several models for varied purposes. Full details in Bulletin 728.

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SHOP EQUIPMENT OF STEEL

SPS STANDARD PRESSED STEEL CO.
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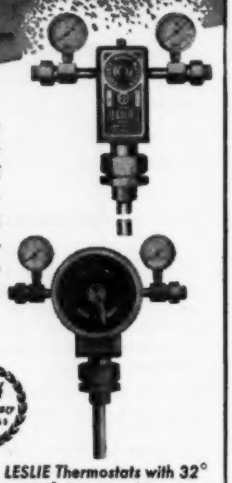
Reduce Water Bills and Maintenance Costs
with the New LESLIE THERMOSTAT
Specially designed for cooling water service with greatly increased throttling range

It is a recognized fact that water cooled equipment, performs better and requires less maintenance if cooling water temperature is accurately maintained. New LESLIE Thermostat and Diaphragm Regulating Valve make an ideal Temperature Controller for this service.



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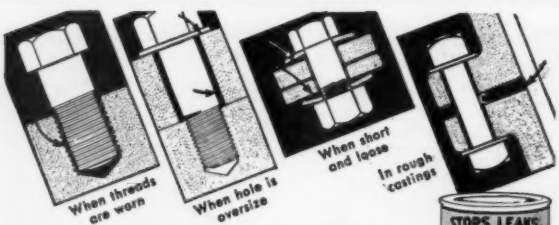
LESLIE Thermostats with 32° —400° F adjustable range and with calibrated dial.

ESTABLISHED 1900 LESLIE CO.
263 Grant Ave., Lyndhurst, New Jersey

PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
FLOATLESS LEVEL CONTROLS • PUMP GOVERNORS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS
AIR HORNS • STEAM WHISTLES



How to Solidly Anchor
LOOSE BOLTS

Bolts with worn threads — undersize bolts in oversize holes — bolts passing through thin walls — bolts holding ill-fitting cast flanges — all can be tightened firmly with quick-setting Smooth-On No. 1 Iron Cement. Use it, too, to lock nuts tight, and to cover and protect countersunk bolt heads in metal or wood. These repairs stay tight because Smooth-On expands slightly as it hardens. Buy Smooth-On No. 1 in 7-oz., 1-lb., 20-lb., or100-lb. size and keep it handy. If your supply house hasn't Smooth-On, write us.

SO-291

FREE REPAIR HANDBOOK

40 pages filled with time-saving, money-saving repairs on plant, shop and home equipment made with No. 1 and other Smooth-On Cements. Drop us a line for YOUR free copy.

SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

Do it with SMOOTH-ON
THE IRON CEMENT OF 1000 USES

rectional changes. Leaks have been permanently banished, optimum flow conditions obtained, and the investment in materials and labor has been rapidly amortized by the reduction in plant overhead.

An illustrated case-history of this economizer modernization program has been prepared by the Engineering Service Department, Tube Turns, Inc.

Wallet Sized Card Pegs Summer Daylight Time

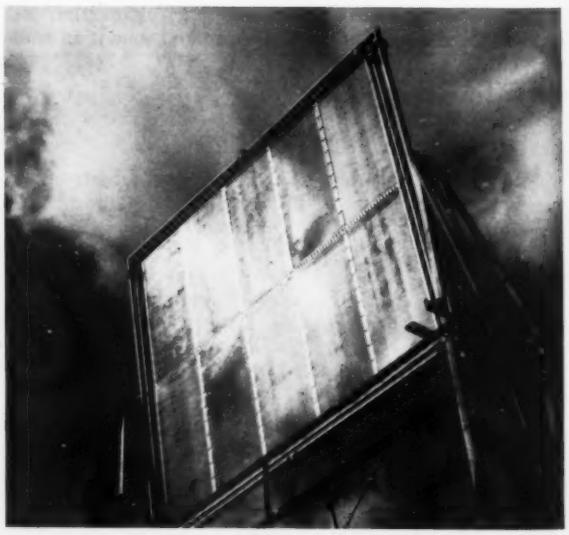
Answer to one of summer's top questions—what city is on daylight saving time and what city is not—has popped up in the form of one of the season's brightest advertising gimmicks. F. H. McGraw & Co., industrial engineering and construction firm of New York and Hartford, has published a handy wallet-sized card that covers every state and city in the U. S. as well as Canada insofar as the type of time being observed.

This presumably is the first time a card of this type has ever been published. The McGraw company plans to distribute the copyrighted card to industrial executives, engineers, construction managers and architectural engineering firms over the nation.

Harbor Construction To Accommodate 1500-Ton Barges

Harbor and mooring facilities for coal barges on the Ohio River near Lawrenceburg, Indiana, are being built for the Tanners Creek Power Plant of the Indiana & Michigan Electric Co. by The Contracting Div. of Dravo Corp. The project, designed to permit unloading of coal barges to supply the power plant, consists of installing approximately 1,000 ft of harbor line by dredging some 25,000 cu yd out of the river.

Eight sheet-steel pile mooring cylinders each 15½ ft



MICROWAVES DEFLECTED WITH MIRRORS

Microwaves employed for communication between the Pennsylvania Electric Company's generating plant and substation are redirected around a hill by this 20-ft sq aluminum sheet. Perforations in the sheet reduce its wind resistance. (Courtesy of Westinghouse Electric Corporation)

in dia and one 42 ft dia sheet-steel pile ice breaker are being installed. In addition, four sheet-steel pile cells topped by a reinforced concrete structure for the coal barge unloader will be built. When completed, the harbor will accommodate nine 1,500-ton or twelve 1,000-ton barges.

"Let's Get Competitive" Series Launched by Industrial Relations Institute

Industrial Relations Institute, with headquarters in the National City Bank Building, Cleveland, Ohio, has launched the first in a series of new low-cost poster campaigns for industry.

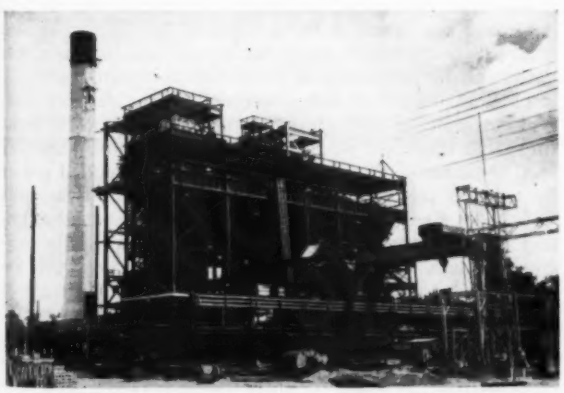
Initial campaign of twelve posters — entitled "Let's Get Competitive" — is designed to help increase rate of production, reduce waste, improve morale, and make production people more cost and quality conscious.

Themes of other campaigns now in process will cover timely economic and social subjects such as the importance of eliminating waste, danger of high taxes, and threat and fallacy of communism.

Sample sets are available to industrial plants and public relations counsellors.

District Heating Problems Aired At NDHA Meeting

"District Heating's Most Pressing Commercial Relations Problem" was the subject of a paper given by J. R. Vernon of the Johnson Service Co., before the annual convention of the National District Heating Association at Asheville,



CAROLINA POWER AND LIGHT CO. EXPANDS PROPERTIES

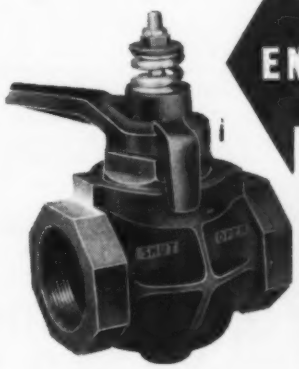
Structural framing, bins and conveyor steel for this large power plant were furnished by Ingalls Iron Works of Birmingham, Ala. The plant is being erected for the Carolina Power and Light Co., and will be known as the Lumberton Steam Electric Station, when it is completed

VALVES THAT DON'T LEAK!

No matter what flows through your pipeline, the valves on that line WON'T LEAK if they're DeZurik Easy-Operating Plug Valves.

DeZurik rubber-faced plugs seal dead-shut on anything from gas to slurries—they do it time after time through long, tough usage, without lubrication or adjustment—and positive savings in time and money.

A PIPE-DREAM FOR ENGINEERS



COMPLETE FREE CATALOG READY FOR YOU

DEZURIK SHOWER CO.
SARTELL, MINN.

TIRED *of operating your zeolite water softeners by hand ? ? ?*

Wasting Time? Salt? Water?

Then ***change*** to fully or semi-automatic (push button) operation using ***H & T*** Poppet Type Multiport Valves.

Send for Bulletin V-1 or A representative will call.

HUNGERFORD & TERRY, INC.
Clayton, New Jersey
Over 50 years experience—Over 5,000 installations

WANTED

Jobs Too Tough For Ordinary Hose

DO YOU NEED FLEXIBLE HOSE THAT WILL SURVIVE THE MOST EXTREME CONDITIONS?

Then weigh the fact that ATLANTIC metal hose has successfully conveyed liquified gases at —183°C and —253°C while flexing at 5 cycles per second.

In another application, ATLANTIC designed hose with a bursting pressure of 3000 psi min. for use in an atmosphere of red fuming Nitric acid.

There is an ATLANTIC flexible metal hose for every known application. Our engineering department will cooperate in new design problems.

Seamless or interlocking flexible metal hose in bronze, steel, stainless steel, monel. 1/8"-36" I.D. inclusive. Standard or special couplings, flanges, nipples, fittings.

See our Catalog in Sweet's File for Product Designers.

Write for Catalog 100.

ATLANTIC METAL HOSE CO., INC.
124 West 64th St., New York 23, N.Y.

Amazing Refractory Cement News!

A chrome base Refractory Cement shipped in dry powder form. Just mix R & I Moldit Chrome with water and pour or trowel in place.

It can be shot in place with a cement gun on walls of furnaces; poured or shot with cement gun on floors of slagging type furnaces and shot or molded around or between side-wall tubes where slag is present.

R & I Moldit Chrome is resistant to slag, molten metal and abrasion. The most severe tests and actual installations have proven this.

REFRACTORY & INSULATION CORP.
119 Wall Street New York 5, N. Y.
Chicago 4, Ill. Newark 2, N. J. Philadelphia 2, Pa.

R&I MOLDIT CHROME
Refractory Cement

N. C. The problems of keeping existing customers happy with clean trouble-free heating at reasonable cost, helping present customers to enjoy added convenience and economy by the utilization of district heating in additional ways, and the securing of new customers were discussed.

Importance of concentrated commercial relations programs to reach potential customers rather than generally dispersed advertising and public relations programs that do not apply was emphasized. Futhermore, the answer to the industry's customer relations programs lies in the building of a personal contact organization, which can settle customer's questions, provide cost figures for prospective customers, and render engineering advice with respect to the use of "street steam". Adequate maintenance of heating plants and control apparatus, suggested rehabilitation of outmoded heating equipment by the installation of modern temperature controls, and other means to achieve the best results from district heating were stressed.

Marquette University Inaugurates Monthly Review Publication

"Marquette Memo," a monthly review of current economic and business topics written for superintendents, foremen and personnel in the lower management strata, made its first appearance at Marquette University, Milwaukee, Wis., with the June issue.

Edited by Leonard J. Bisbing, director, Bureau of Business and Economic Research at Marquette University, the publication is aimed at interpreting for the layman the implication of present developments in the fields of labor, economics, government, and finance. It will be distributed on a national basis.

Brief articles contained in the issue were written by Marquette College of Business Administration faculty members and by civic and business leaders. Contributors for the June issue included: Walter Geist, president of the Allis-Chalmers Mfg. Co.; Bishop Brown, director of the Research Bureau for Retail Training at the University of Pittsburgh; and Father Thomas F. Divine, S. J., Marquette Business Administration dean.

Questions to be treated in future issues of the "Memo" will be: "Are Business Firms too Large?", "Is There too Much Government Participation in Business?", and "Should Government Support Farm Prices?"

Inland Steel Installs New Pickling Line

Electrical equipment, including drives, controls, switchgear, and auxiliaries, is being supplied by GE for Inland Steel Company's new 60-in. pickling line. Increased capacity for the production of sheet-steel is expected.

Shallow, instead of deep immersion on the delivery end, will be employed through the use of twin rolls in the pickling tanks combined with GE amplidyne control. Catenary loop is maintained by strip slack, which is controlled either by a dancer roll or magnetic detector unit. The twin rolls will be in fixed position to maintain a constant position, and delivery tension will be held by the amplidyne control. Tension, once pre-selected by the operator, will be maintained automatically for all strip speeds throughout the operating range.

Main motor-generator set will consist of a six unit combination including a 1250-hp, 6600-v, 750-rpm synchronous driving motor, two entry-end generators, two delivery-end generators, and one general-purpose exciter generator. This will allow complete individual control of each of the main line sections without interaction between sections. But, all sections will be held in co-ordination to provide desired strip tensions throughout strip speed ranges by means of a completely integrated master control system.

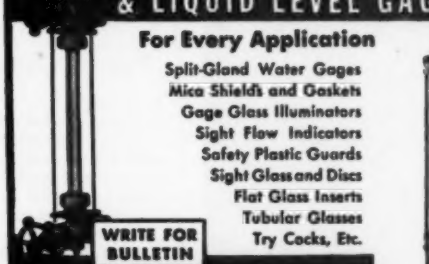
AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Boiler Houses Are Necessary Evils", February, 1950.
"Caribou Diesel Plant Built in a Hurry", February, 1950.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . . " October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
"Goshen's 3200 HP Diesels Also Generate Steam", March, 1950.
"Grievances Can Be Avoided", April, 1950.
"How To Select Correct Steam Trap", Thomas Trail, January, 1950.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Low Cost Auxiliary Power From Turbine Drives", April, 1950.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Catlell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

ERNST WATER COLUMNS
& LIQUID LEVEL GAGES



For Every Application

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Mica Shields and Gaskets
Gage Glass Illuminators
Sight Flow Indicators
Safety Plastic Guards
Sight Glass and Discs
Flat Glass Inserts
Tubular Glasses
Try Cocks, Etc.

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LIVINGSTON N. J.

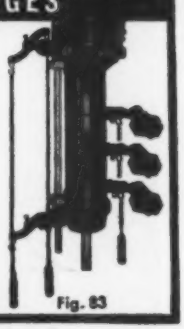


Fig. 83

For a Quick Review of

AVAILABLE LITERATURE

Describing Equipment Advertised

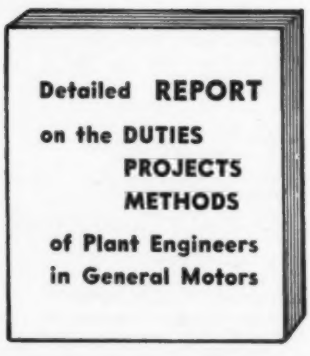
in this issue

CONSULT OUR

READERS' GUIDE

Starting on Page 26

For your convenience in requesting this literature coupon postcards are provided on page 37. Circle the numbers of the items desired and mail a card to INDUSTRY and POWER, St. Joseph, Michigan. Your inquiries will be handled promptly.

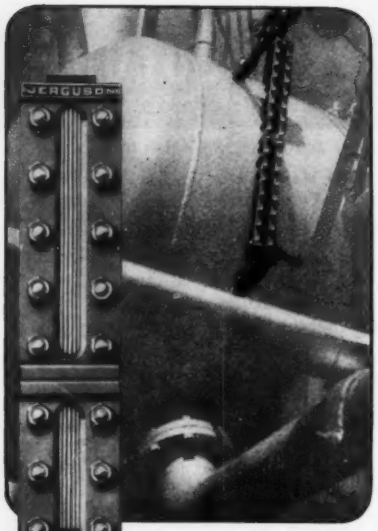


now at ½ price!

Only a few copies remain of this 48-page report reprinted by popular demand from the September, 1949, *INDUSTRY and POWER*. You'll find this factual, illustrated study of plant engineering at GM will help you solve your day-to-day problems of modern plant operation.

Order your copies from *Industry and Power*, 420 Main St., St. Joseph, Michigan.

order your copy today – only 25c



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Jerguson Reflex Gage

They keep you out of trouble . . . and Save You Money

You get a lot of plus values . . . and avoid a lot of failure headaches and possible accidents . . . by using Jerguson Flat Glass Gages for every liquid level indicating use.

You get the kind of gages and valves you want to do YOUR JOB. Jerguson offers you the most complete line available. Jerguson offers you an engineering organization specializing in building special gages to meet problems.

Jerguson Flat Glass Gages save money and labor. They are easy to install. They stand up . . . you don't have to keep servicing them or replacing the glass. They are available in a wide range of sizes, pressures, designs and materials; also with polished end stems to replace present tubular gages.

Write us about your problems or requirements.

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Gages and Valves for the Observation of Liquids and Levels

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Representatives in Major Cities
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Monsanto SANTOBRITE controls slime and algae in cooling towers

Slime and algae, enemies of good cooling tower operation, are kept under control by Santobrite (Monsanto's sodium pentachlorophenate, technical). Santobrite is economical...easy to use...efficient.

If slime and algae cause trouble in your cooling towers, it will pay you to read Monsanto Technical Bulletin No. O-15. For your copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk A, 1743 South Second Street, St. Louis 4, Missouri.

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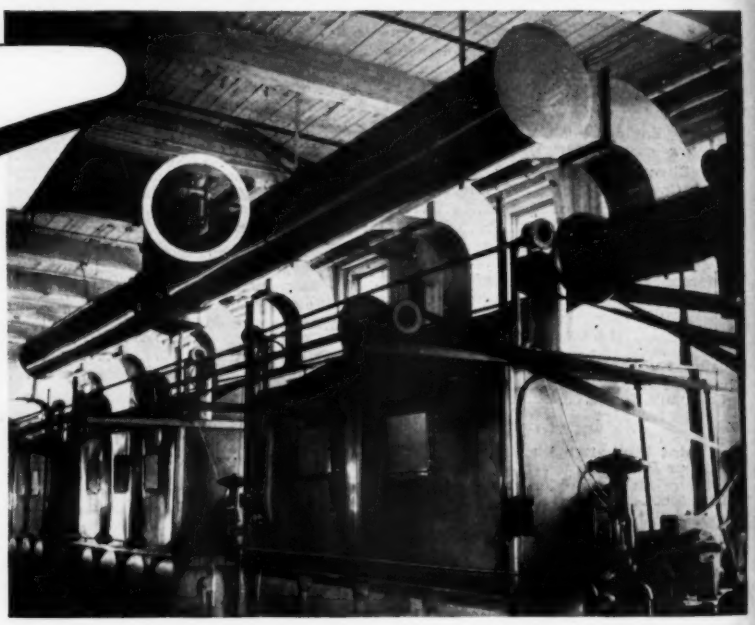

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